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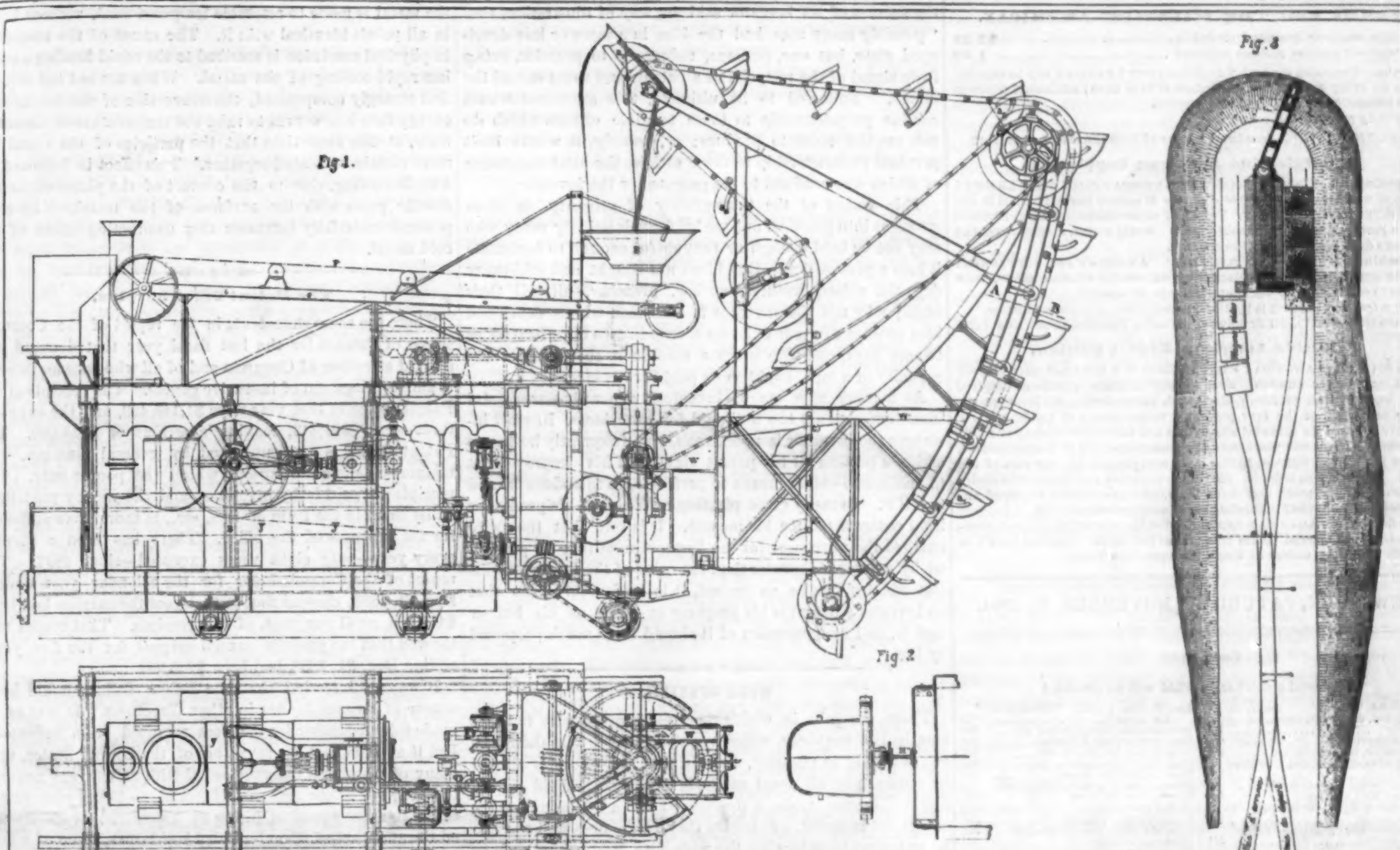

Fig. 1.—Details of the Apparatus. (Plan and elevation, on a scale of 1-40.) Fig. 2.—Plan of Bucket and Guide (Scale 1-20). Fig. 3.—Arrangement of Track (Scale 1-200)

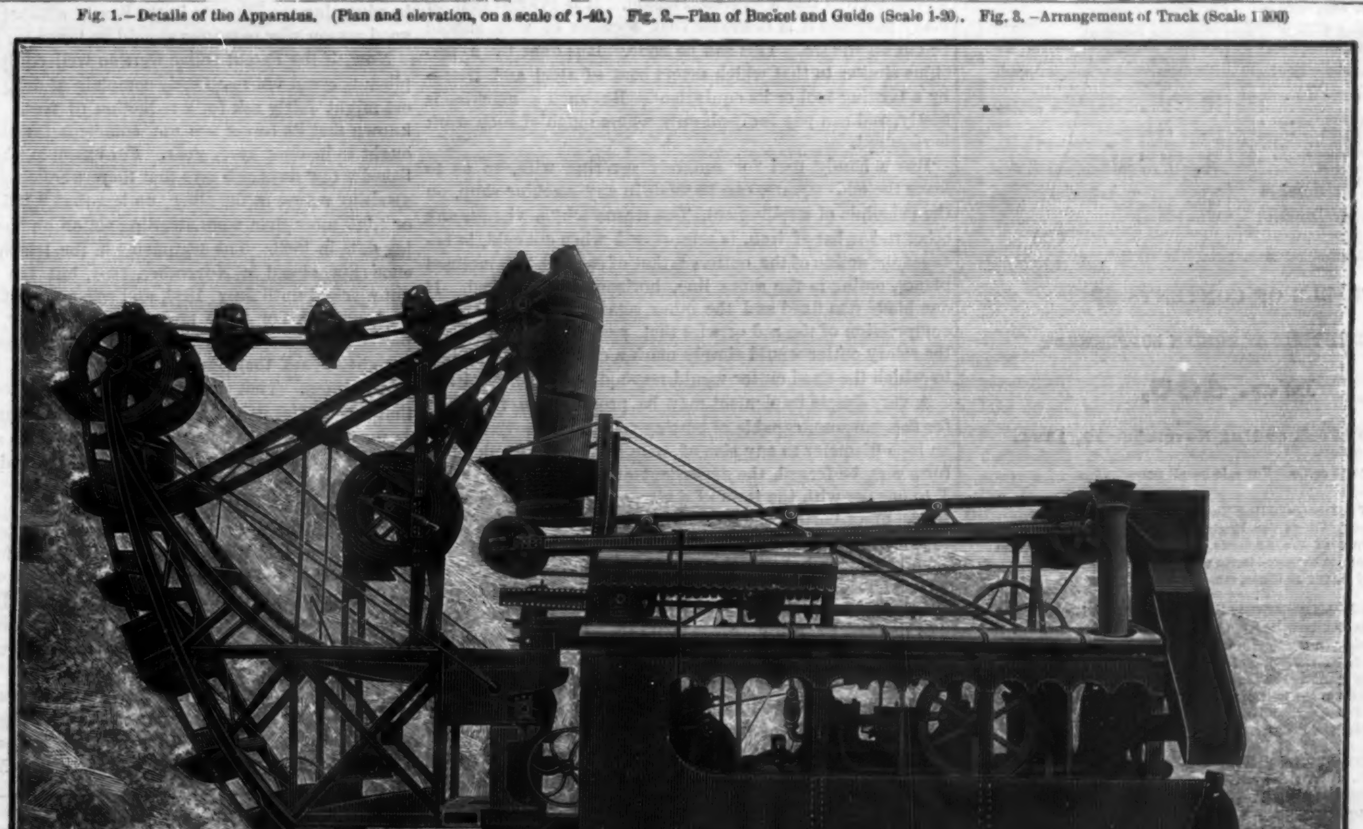

Fig. 4.—JACQUELIN & CHEVRE'S STEAM EXCAVATOR.—[See page 339.]

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 465,

For the Week ending November 29, 1884.

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PROPERTY IN PATENTS.

There is a prejudice against patents. It may not be general; it may be only a lingering, remaining shadow of a once popular notion; but it crops out occasionally in conversation, in trading, in the newspaper, and even in the legislature of the country. Recently a customer in an agricultural warehouse refused an implement and questioned the price because it was a patented article. He said that all patented articles had a fictitious value attached to them. Some time ago a New York city paper published an article arguing against the issuing of letters patent, on the ground that "it is questionable if ideas can be bought, and sold, and protected in the same way as goods and chattels;" and in relation to the success of an inventor said, by way of illustration, that "possibly many men had the idea in a more or less developed state, but one, perhaps, reduces it to practice, gets a little ahead of the rest, claims a patent, and shuts out all the others." Followed to its ultimate, this argument would confine proprietorship to those tangible objects which do not require ideas to produce; or, soberly, it would limit personal proprietorship to those articles the ideal suggestion of which was confined to the patentee or the inventor.

This notion of the intangibility of property in ideas wrought into practical and useful form is held by many who may not be bold enough or thoughtful enough to formulate it into a proposition. But ideas are bought and sold every day; the writer, lecturer, author, preacher, all sell their ideas; why not the inventor? The man whose developed idea enables a farmer to house a crop in two days instead of twenty days, one who invents machinery that doubles the capacity of a mill, ought to be paid for his idea.

As matters now stand, inventors generally—successful inventors—are not too well paid for their ideas. In most instances the inventor is a poor man, and frequently he has to assign a portion of his patent right or of his improvement to another to obtain means to perfect it, to introduce it, and to sell it. In many cases pirating robs him of his profits, or legal contests reduce his income. It is rare that the price charged the purchaser for the improvement that is protected by a patent is greater than the value of the improvement. But whether this be so or not, it is undeniably true that an inventor's patent is his property as much as his hat or coat is, and his possession of it should be as much protected by law.

WIRE CUTTING.

There are jobs in which the treatment of wire in short lengths is a requisite, which require that the wire should be cut as evenly as possibly, that is, that the end cut should be square. In all usual methods the wire is held rigidly and immovable, while a downward or a swinging cutter severs the material. It is rare that a wire or small rod can be so cut without leaving the wire with jammed-in ends or a cross section like a squeezed lemon. It is evident that for many purposes it is desirable that sections of wire should be cut off square. This can be done. It is done by a machine similar to that which severs bars of steel and iron—by a turning tool or its equivalent. But such a machine is costly, and can pay for itself only where much of such work is required.

But a handy tool for squarely severing wire, so as to leave the ends square, can be made in any machine shop, on the principle of a rolling cut. The reason why a wire, or any other rod or bar of iron, is compressed when cut cold, is because the action of the cutters is that of shears—two inclined planes, acting in the same line, horizontal or vertical. If one blade was fixed and the other rotary, there need be no compression of the rod or wire that passed between them; the rotary cutter would simply mark a circumferential line, to which the fixed cutter would respond by deepening it.

A very simple implement may be produced in the shop for this purpose, capable of cutting rods from one quarter of an inch diameter to any size of wire. A steel blank of T form may be forged, the dependent or lower portion of the T to engage with the jaws of a vise, or be seated in a bench. In the other portion should be drilled a series of holes to fit the sizes of wire to be cut, all the holes on a line—horizontal—and another hole at the end of them to receive a bolt to hold a lever. The lever should be of steel at its acting portion, and both it and the standard be ground, and hardened, and tempered. But the lever should have at its pivot end a curved slot to engage with a fixed pivot in the standard, so that when brought down on the rod or wire it would slide over it, inducing a rolling of the rod or wire, cutting a score entirely around it before being "brought up" by the end of the curved slot against the fixed pivot or stud. The curve of the slot can be easily calculated, so that the cutting off action will suit all diameters within a range of from quarter inch to No. 6 wire or even much smaller.

A New Process for Toughening Steel.

The French Societe d'Encouragement have had under prolonged examination a process invented by M. Clemandot for working steel. This process is described by the *Revue Industrielle* as consisting in heating the metal until it acquires a sufficient ductility, and then subjecting it to high pressure during cooling. In this way a modification of the structure of the metal is produced, and the metal acquires properties analogous to those developed by tempering. It is admitted that the compression of steel has already been practiced in England by Whitworth; but, it is contended, merely with a view to prevent air holes caused by the development of gaseous bubbles during the solidification of the steel. Similar processes have been tried in France, but only upon the same principle—that is to say, by operating upon the metal while yet in the state of fusion. M. Clemandot, on the contrary, takes steel already made, heats it simply to a cherry red, and submits it, by means of a hydraulic press, to pressures of from 1,000 to 3,000 kilos. per square centimeter. After having allowed the steel to cool between the two plates of the press, it is withdrawn with all its new qualities perfectly developed, and does not require any further treatment. The result of the process is to impart to the steel a fineness of grain, a degree of hardness, and a notable accession of strength to withstand rupture. This alteration is most considerable with highly carbonated steel; and in this respect the metal is made to resemble tempered steel, without being in all points identical with it. The cause of the alteration in physical condition is ascribed to the rapid heating and no less rapid cooling of the metal. When the red hot steel is first strongly compressed, the conversion of the mechanical energy into heat serves to raise the temperature of the entire mass, at the same time that the particles of the metal are more closely cemented together. This effect is followed by a rapid cooling, due to the contact of the plates of the hydraulic press with the surfaces of the metal. The close pressure materially increases this conducting effect of the cold metal.

The Patent Office Surplus.

There are some statements in the report of the Commissioner of Patents for the last fiscal year that demand the careful attention of Congress and of all who take an interest in the development of inventive genius. The receipts of the Patent Office in that year were $1,145,433, and the expenditures were $901,413, leaving a surplus of $244,020. The Patent Office is not supported by general taxation. Its maintenance is not a burden which the people bear. The receipts are paid in by inventors, and the money contributed by them in the form of fees, etc., is more than sufficient for the expenses of the office. There has been a surplus every year—only eight years excepted—since 1837. The report of the Commissioner for the calendar year ending Dec. 31, 1883, showed that in that year the surplus had been $471,005, or 41 per cent. of the receipts. That report also showed that the average annual surplus for the five years ending Dec. 31, 1883, had been $285,992.

It was not intended that the Patent Office should be a source of revenue for use in other directions. It was to be made self-sustaining by the fees required from inventors. But it appears that the inventors of the United States, very many of whom are not overloaded with money, pay not only the expenses of the office, but from 25 to 40 per cent. in addition to those expenses, piling up a surplus that has attracted the attention of liberal-minded legislators, some of whom have proposed that it should form part of a fund to be used in educating the illiterate in the South, without showing any good reason why patentees should be taxed for that purpose.

Now, if the Patent Office were so well equipped that applicants could not reasonably complain of delays, the inventors might fairly ask for a reduction of fees. But it is well known that its forces are not sufficient for the work that ought to be done every year. For example, the report published a few days ago says that there were on June 30, 1884, awaiting action in the office, no less than 9,186 applications, or 5,087 more than were awaiting action on the corresponding date in 1883. The arguments in the telephone interference cases closed in November, 1881, but the decision was not reached until July, 1883, and was not confirmed, on appeal, until two or three months ago. Surely, if inventors pay so much more than is required for expenses, they have a right to ask that their applications shall be promptly passed upon. That the force employed is too small, and that the salaries paid are so low that many examiners resign as soon as they have become qualified by their experience to serve as patent attorneys, has been shown again and again by Commissioners.

Because there is a large surplus it does not follow that there should be a general reduction of fees, but it does follow that inventors should be given the worth of their money, and not be forced to submit to delays that sometimes very seriously affect the value of their inventions. It may be that more than one Government bureau can be found in which the number of clerks might be reduced without doing any harm, but in the Patent Office the number of employes should be increased, and it is folly for Congress to disregard the requests of the Commissioner and the arguments suggested by the annual surplus and by the figures which show an accumulation of untouched applications.—*N. Y. Times.*

Criminal Plumbing.

The trial of Thomas C. Holland, plumber, of this city, for criminally negligent work, was held before Special Sessions, November 6, and resulted in the imposition of a fine of $250. In default of payment Holland was sent to prison. Dummy vent pipes from washbasin traps had been run into partitions and there terminated. The ends of these vents had been roughly battered together, but were, of course, not tight, and allowed foul air to escape into the partitions. The whole arrangement was designed simply to deceive the Board of Health inspectors; and to assist in carrying out the deception a dummy terminal pipe, supposed to be the end of a ventilating pipe, was fastened to the roof. The dummy had no connection with any *bona fide* pipes inside the house.

ASPECTS OF THE PLANETS FOR DECEMBER.

SATURN

is morning star until the 12th, and, after that time, joins the increasing company of evening stars. He stands at the head of the roll during the month, for he reaches, in its passage, the most important epoch in his career, as far as terrestrial observation is concerned.

On the 12th, at 2 o'clock in the morning, he is in opposition with the sun, opposite to him in the heavens, as far away from him as possible. When, in these short days, the sun hastens to hide his red, round orb below the western horizon, then this beaming planet shows his radiant face above the eastern horizon, and shines during the entire night, slowly descending in the west as the great day-star appears rejoicing in the east.

Any intelligent observer can find Saturn's place in the sky, for he is nearly east of the Pleiades, and about half-way between Capella on the north and Betelguese on the south. He shines also with a serene light, entirely different from that of the twinkling stars. He rises on the 1st at a quarter after 5 o'clock in the evening, and is the only visible planet in the heavens till nearly midnight, when Jupiter appears upon the scene. The conditions under which Saturn may now be observed are very favorable, but they will not reach their culmination until the opposition of 1885, for he will then be farther north, and only a month past perihelion. He will at that time be about 100,000,000 million miles nearer the sun than at aphelion, and since perihelion and opposition nearly coincide, about the same distance nearer the earth.

The telescopic Saturn is now the personification of grandeur and sublimity. Even in a small instrument the picture is one of surpassing beauty. "I have seen the planet single, and now I see it double," was Galileo's wondering exclamation as he turned his imperfect instrument to the heavens in the dawn of the astronomical day. It was not till forty years later that the strange appendage, sometimes visible, and sometimes invisible, was proved to be the rings of Saturn. With our finer instruments, and the flood of knowledge gained from observation and research, we have still to thank the pioneer astronomers for the first fruits of this noble science, and for a devotion to the cause which cost them obloquy, imprisonment, and even martyrdom.

A very powerful glass is required to bring out the magnificent and also the delicate aspects of the most charming telescopic object in the heavens, as well as the brilliancy of coloring which is a grand feature in the Saturnian system. Mr. Browning, an optician, and a practical and enthusiastic observer, thus describes the coloring of the planet on one of the exceptionally fine nights that are the delight of the telescopist. The rings were gold in varying tints, shaded with brown; the body of the planet was yellow, orange, red, purple, shaded with brown; the division in the rings, pale brown; and the poles and narrow belts near the poles were pale blue. "But," said the observer, "there is a muddiness about all terrestrial colors when compared with the objects seen in the heavens. Those colors could not be represented in all their brilliancy and purity, unless we could dip our pencil in a rainbow and transfer the prismatic tints to our paper."

Saturn, now so pure in tint and tone, and so beautiful a member of the starry host, before many years have passed will change his aspect, as his rings begin to close, and as he bends his steps southward. He will again become the planet that in ancient times, on account of his dull yellow and dismal hue and sluggish motion, was held by astrologers to exert a malevolent influence on human affairs, and to be the source of many of the evils to which the human race is subject. Chaucer embodies the belief of the day in the following address of the god Saturn to Venus:

"My dere daughter Venus, quod Saturne,
My cours, that hath so wide for to turne,
Hath more power than wot any man.
Min is the strangel and hanging by the throte,
The murmure and the churles rebelling.
I do vengeance and pleine correction
While I dwell in the sign of the Leon.
Min is the ruin of the high halles,
The falling of the towers and of the walles
Upon the minour or the carpenter.
I slew Sampson in shaking the piler."

Science has changed all this. The ill-omened star is raised almost to the dignity of a sun. Saturn's eight satellites equal the sun's family of worlds. His rings, made up of myriad minute satellites, circling around the central orb, respond to the sun's family of asteroids. It is not improbable that enough of his primeval fires remain to give out heat and even light to the worlds of satellites and rings that own him as their lord.

Such are some of the claims to notice of the ring-girdled planet that on the 12th reaches the goal when it is at its nearest point to the earth during the present year.

The right ascension of Saturn on the 1st is 5 h. 23 m.; his declination is 21° 41' north; his diameter is 19·4"; and he is in the constellation Taurus.

Saturn rises on the 1st at a quarter after 5 o'clock in the evening; on the 31st he sets a few minutes before 6 o'clock in the morning.

URANUS

is morning star. His course during the month is marked with an event that would be vastly more important to terrestrial view if it were not for his great distance. On the 24th, at 2 o'clock in the afternoon, he is in quadrature with the sun on his western side, half his course from conjunction to opposition being then completed.

The right ascension of Uranus on the 1st is 12 h. 9 m.; his declination is 0° 16' south; his diameter is 3·6"; and he may be found in the constellation Virgo.

Uranus rises on the 1st about half past 1 o'clock in the morning; on the 31st he rises at half past 11 o'clock in the evening.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 17th at 7 o'clock in the evening, and is then 20° 12' east of the sun. He may be seen at that time by the naked eye, if the atmosphere be clear and the sky cloudless. His great southern declination will, however, make him a difficult object to pick up. Observers inclined to try must look for him about the 17th, nearly a degree south of the sunset point, in the constellation Sagittarius, a short distance northeast of the bowl of the inverted dipper.

The right ascension of Mercury on the 1st is 17 h. 36 m.; his declination is 25° 33' south; his diameter is 5·2"; and he is in Sagittarius.

Mercury sets on the 1st at a quarter past 5 o'clock in the evening; on the 31st he sets at 20 minutes past 5 o'clock.

MARS

is evening star. His path is in close proximity to that of Mercury, so that the two planets are twice in conjunction during the month. The first conjunction occurs on the 4th at eleven o'clock in the evening, when Mercury is 1° 26' south of Mars. The second conjunction occurs on the 29th at midnight, when Mercury is 2° 25' north of Mars. The events are noteworthy simply as interesting planetary aspects, for both planets are too near the sun to be visible.

The right ascension of Mars on the 1st is 17 h. 46 m.; his declination is 24° 17' south; his diameter is 4·2"; and he is in the constellation Sagittarius.

Mars sets on the 1st at half past 5 o'clock in the evening; on the 31st he sets a few minutes before half past 5 o'clock.

JUPITER

is morning star during the month, making his last appearance for the present in that role. The interest in his movements greatly increases as he draws nearer the earth. He rises now an hour before midnight, and when the month closes will make his appearance above the eastern horizon at 9 o'clock. He is still in the neighborhood of Regulus, a few degrees east. The brilliant planet and the first magnitude star afford a fine opportunity for contrast between a planet and a star. Jupiter is superb and growing more so, and after he appears upon the scene he holds the scepter of sovereignty with a power that the brightest star of the myriad host may not dispute. Even Saturn beaming mildly from the empyrean treads the celestial pathway with becoming humility in the presence of his more powerful brother. Jupiter is almost alone in his present position. He has left behind him the grand galaxy of stars among which for the two previous years he made his shining way, and Regulus is his sole bright companion.

The right ascension of Jupiter on the 1st is 10 h. 29 m.; his declination is 10° 28' north; his diameter is 36·2"; and he is in the constellation Leo.

Jupiter rises on the 1st at a few minutes after 11 o'clock in the evening; on the 31st he rises soon after 9 o'clock.

VENUS

is morning star. She is still a charming object in the eastern sky for two hours before sunrise, and is brilliant enough to hold her place till it is nearly time for the sun to appear. Though her luster is decreasing, she holds her own in the presence of Jupiter, the two planets remaining visible after all the stars have disappeared in the increasing light. The November dawns were made lovely by the presence of the two bright orbs. The December dawns will be equally charming from their continued presence, and observers will not need to rise very early to be present at the exhibition.

The right ascension of Venus on the 1st is 14 h. 11 m.; her declination is 11° 9' south; her diameter is 14·2"; and she is in the constellation Virgo.

Venus rises on the 1st at 4 o'clock in the morning; on the 31st she rises not far from a quarter after 5 o'clock.

NEPTUNE

is evening star. After the 12th, the evening stars are in the preponderance, numbering on the list Mars, Mercury, Neptune, and Saturn.

The right ascension of Neptune on the 1st is 3 h. 17 m.; his declination is 16° 23' north; his diameter is 2·6"; and he is in the constellation Taurus.

Neptune sets on the 1st at half past 5 o'clock in the morning; on the 31st he sets at half past 3 o'clock.

THE MOON.

The December moon fulls on the 2d at 2 o'clock in the evening. The moon is at her nearest point to Saturn on the 3d, and to Jupiter on the 8th. She is in conjunction with Venus on the morning of the 14th, at 37 minutes after 4 o'clock. The morning star and the lessening circlet of the moon, only a degree and a quarter apart, will be lovely to behold as they make their appearance on the celestial scene, the picture remaining visible until it is nearly time for the sun to appear. The moon pays her respects to Mars on the 18th, the day after her change, and to Mercury on the 19th. On the 28th, she is in conjunction with Neptune, and on the 30th she passes Saturn for the second time within the limits of December.

Our satellite hides no large star from the view of observers in that latitude. But observers farther north, between the limiting parallels of 90° and 54° north, will be privileged to behold on the 29th, if they chance to be on the dark side of the earth, the occultation of Alpha Tauri, or the first magnitude star Aldebaran, the next best thing to the occultation of a planet.

Take Care of Farm Implements.

Some one once drew a graphic pen picture of a mortal foe of the farmer—one who labored for his destruction by night as well as by day, on Sundays, holidays, and work days alike. It was a "mortgage" that the writer of the sketch wisely regarded as one of the most active enemies to the farmer's purse and peace of mind.

There is, however, another agent for evil quite as active, to be found on every farm. It is known as rust. And although it annually destroys in the aggregate a vast amount of property, farmers too frequently neglect to take the measures necessary for protection from the ravages of this insidious foe. Hundreds of agriculturists are buying farm machinery, which, if properly cared for, the *Forest, Forge, and Farm* suggests, ought to last at least ten years. Most of it will be worthless in one-fifth of that time for lack of a little care.

A machine that is taken apart and properly cared for when not in use will do good work years and years after its counterpart has been thrown away by the man who had the habit of leaving it unprotected. Then the delays caused by broken machinery, loose bolts, and rotten or twisted frames, discovered just at the time when the loss of time means danger to the crop, more than counterbalance any time, trouble, or expense incurred in properly putting away the machine. The provident farmer will always clean and house his implements as soon as the harvest is ended. Whenever the paint on an implement shows signs of wearing off, it ought to be renewed. And when tools and implements are housed they should be placed just where they can readily be found when again sought for.

Chloroform Syncope Treated by Reversing.

As a valuable hint, we note that in the *British Medical Journal*, Dr. Albert I. Garland relates a case wherein he began to operate on a lady, aged forty-one, for the removal of scirrhus of the mamma. After examination of the heart, which was found normal, they commenced administering chloroform; but the cardiac action becoming very excited, a mixture of chloroform and ether was used. She was some minutes going under the influence, but there was scarcely any struggling, and the pulse was full, though jerky. He had not finished the incisions round the tumor when she suddenly became livid, and the pulse ceased. Artificial respiration was begun, the tongue drawn forward, and strong ammonia applied to the nostrils, without avail. He immediately jumped on the bed, and seizing her legs, raised the body, allowing the head to touch the bed. In a few seconds the color returned to the lips and the pulse to the wrist. Artificial respiration was soon resumed; hot water applied to the region of the heart; and she became sufficiently conscious to speak and to swallow some brandy and ammonia, soon, however, relapsing, pulse and respiration ceasing again. He again reversed, with the same result; but in a short time the syncope returned, and after applying the battery without success, he again reversed, and this time with a satisfactory result, as he was enabled, by the use of the battery and ammonia, to establish reaction.

He considers his case worthy of record, as the successful termination was clearly due to reversing the body, it being impossible, apparently, to stimulate the nerve centers by any other means; and it is a method of treatment which, he thinks, is not used so often as it deserves to be, judging by the reports of such cases, as he only remembers having seen it mentioned in one instance, and it is one so easily and quickly adopted.

A Great Lake East of Hudson's Bay.

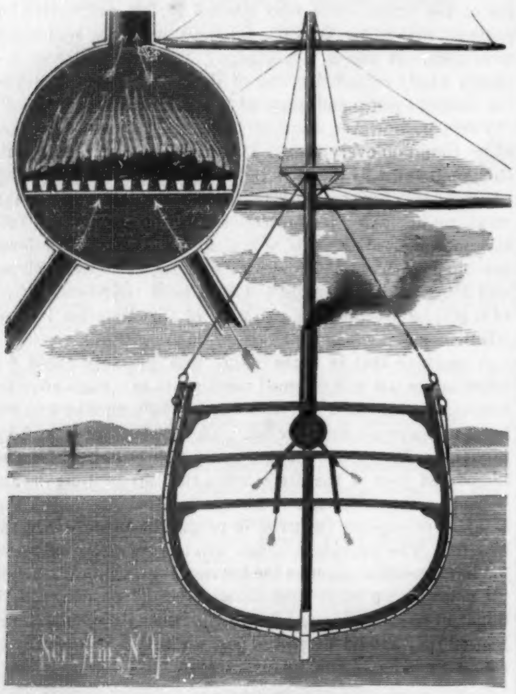
Mr. F. H. Bignall, of a Canadian geographical society, has just returned from an exploring expedition to the northeast of Quebec, an expedition which left in June last, to discover, if possible, a great inland sea which has for some time been identified with Lake Mistassnii, just north of the Province of Quebec. Mr. Bignell did not belong to the main expedition, which was equipped for an eighteen months' stay, but he reports having navigated 120 miles on a great lake, which he assumes to be an expansion of Rupert River, without having really reached the body of the lake. He says it lies from southwest to northeast, stretching toward the Labrador coast, between low-lying banks, and probably covers as much area, at least, as Lake Superior. The existence of such a body of water in this hitherto almost totally unexplored region has heretofore been the subject of many rumors, and further authentic reports will be looked for with great interest.

An Ingenious Blacksmith.

Mr. Charles Dunster, a blacksmith of Leesville, Ohio, has made a clock, mostly with blacksmith's tools, which has excited considerable comment in his neighborhood. It is principally of steel, and in a glass case so the movement can be seen, gives the time in eleven cities, striking the hours and quarters, and is seven feet high.

NEW SYSTEM OF VENTILATING VESSELS.

An improved system of ventilation for marine vessels has been patented by Mr. J. M. J. Barton, of 300 Pitt Street, Sydney, Australia. A series of pipes extends from the several compartments in the vessel to the furnace, which is closed perfectly at the bottom; the doors are made to fit very closely, so that no air can pass to the fire except through the pipes provided for that purpose. The fire in the furnace causes a draught, and as no air can enter except through the



BARTON'S NEW SYSTEM OF VENTILATING VESSELS.

pipes, a powerful suction will be produced, and the foul air in the several parts of the ship will be drawn into the furnace; fresh air will naturally pass into the compartments through passages provided for the purpose. The inner ends of the pipes are closed by gratings, to prevent the entrance of live coals. In the engraving, the upper figure is an enlarged cross section through the boiler and pipes.

This device can be applied in any marine vessel, but is especially adapted for steamers, as the furnace of the boiler could be utilized; in sailing vessels a special furnace would have to be provided.

HAND POWER FOR SEWING MACHINES.

The object of an invention patented by Mr. Elijah Wright, of Coldwater, Miss., is to provide a simple, efficient, and inexpensive hand power attachment to sewing or other light machines, whereby the injurious effects of a continual use of the treadle may be avoided. The hand lever is hinged to lugs of a plate attached to the sewing machine table, and at a short distance from the pivot it has a transverse enlargement, in which are formed three slots, as shown in Figs. 1 and 2. From the outer end of the enlargement the handle proper of the lever ranges forward at about an angle of forty-five degrees, and in a gentle curve, making it easy to grasp and operate. The end of the pitman, which usually connects with the treadle, is by this plan passed loosely on the round end bearing of a pivot stud, which is adapted to enter either of

WRIGHT'S HAND POWER FOR SEWING MACHINES.

the slots; the screw-threaded portion of the stud extends through the slot to receive the thumb nut. A pin passed through the stud outside of the pitman keeps the latter in place. This construction is very clearly indicated in Fig. 2.

It is evident that by forming transverse slots in the lever provision is made for attaching pitmen of various lengths; hence this hand power may be connected with any ordinary sewing machine by varying the location of the pivot stud. The lever will be out of the way of the operator working the machine by the treadle to which the pitman then connects; and when wearied the operator can rapidly disconnect the pitman from the treadle, and join it to the lever to work by hand power.

The Human Face.

BY D. Y. CLIFF.

When man first detected that the voice, sight, hearing, smell, and taste were all situated in and emanated from the head, he looked upon it, and its contours and proportions became to him comparable and beautiful; he said, grandly, "It is the image of God!" How much does the rest of the body owe to carnal passions and "pride of might"? Admiration and appreciation have surely played a large part in our development. The intellect animal looks to the face—has it an idea of beauty? Do we recognize "beauty" in the brute creation from long inbred association, or have they themselves had a hand (or an eye) in it? The fact that it contains scarcely anything to cringe or terrify us, at first sight, would seem to prove this inbred familiarity. We find nature to be born *in* and *of* ourselves. There are more dangers in the artificial productions of man than in the structures of Nature. The eye reaches further than the weapon; and it is easier to fall from a window than from a tree.

Some say the national face does not change, its apparent differences being the result of fashion—costume, hat, hair, etc. For my part it seems that the history of each age is painted on the faces of its people. Parents would seem generally to anticipate (or form) in fancy the realities of their offspring—probably unknowingly. I have on several occasions been struck by odd faces here and there which belonged to a past age. Some will, of course, smile at this. Once, *e. g.*, at a sham parliament in a Cheshire town, I saw an exact reproduction of the face (as generally represented) of the Georgian epoch of English history. The high cheeks, the ruddy skin, particularly the wide, low forehead with its distinctive depression (almost) in the middle of the forehead where the head curves downward, the broad face, the peculiar "look," etc.

The face of Charles I. suggests his artistic taste, his theological thoughtfulness (so general then), and a proud indifference to vulgar rowdyism. He was to his age what "Farmer George" was to his, and the Prince of Wales is to his—types thereof—the men thereof bearing one of its varied educations, but the same generally under each disguise.

It would be a long subject to discuss the features of the different ages in English history and speculate upon them, and perhaps foreign to this journal. It is this feeling we have, this recognition of a fact, that hurts our fancies to see an ugly artist, a handsome slave, and sometimes to wonder at the beautiful eyes some of our domestic animals possess. We find an innate pleasure in gazing on a handsome face.

The above causes, no doubt, have lent a diversity to the face of woman which reacts on the man. The favorite type is "married up" in excess of others, and effectually impressed on the race. To this we may trace, probably, the widely diverged races of men, the Mongol, the Negro, the European, etc. The transmission of the family likeness, paternally and maternally, is interesting to reflect on. That was a scandalous remark, to me, I read, I think in your journal, about the passing admirations of a mother being stamped on her children's faces. Why is not the husband, the favorite brother, the sister, the mother, father, etc., oftener reproduced, if that be the case—with the double chance? It is remarkable, though, that the eldest child seems very often to retain the strongest family likeness. But the strong likeness of brothers and sisters is an argument against it. Perhaps this is largely owing to their catching each other's expressions of countenance; and this again explaining why the "younger end" often differ so decidedly from their elders—lack of association. This same thing applies to nations; hence the force of the child's remark, "All Frenchmen seem to grin alike." A national contortion.

One would like to have seen the face of the Persians who made it part of their education to "speak the truth." We could have seen it! *Was* the Spartan stern in aspect who lived for his country's good? Was Deborah a Jewess in her look? Can we not read Byron's poetry in his face, and the heaviness of pondering judgments in Hallam's? Do you doubt, as you look at Nero's face, that he could fiddle while Rome burnt? And so on; a man's mind shines out of his countenance, the face in repose, or unanimated, is the generality of that individual's mind. And so we turn to look on the faces around us to-day. Are not the majority mere livers—mere nonentities? These will not remain in history, but they will form the nation's destiny!

Our souls were filled with sadness when we found inanity behind a lovely face. Nature lied to us! Do the choice minority conquer in the long run? It is one long fight.—*Jour. Science.*

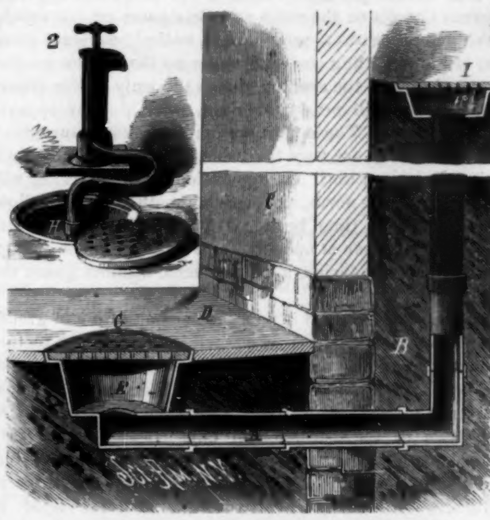
Test of Glue.

The *Tischler Zeitung* gives the following method of testing glue: Carefully weigh a piece and suspend it in water, at a temperature not exceeding 10° C. (50° F.), during 24 hours. The coloring matter is then precipitated, and the glue swells in consequence of the absorption of water. On removing the glue from the water, the increase in weight will be found to be in proportion to the quality. The weight of the coloring matter can also be ascertained by weighing the glue a second time after it has been thoroughly dried.—*Chron. Industr.*

CELLAR DRAIN AND VENTILATOR.

The drain and ventilating pipe, A, is sunk into the ground at the outside of the cellar wall through which it is passed, and conducted beneath the cellar floor, which inclines downward from the walls to a receiving basin, E, fitted with a perforated top, G, to pass air and to prevent solid matters from entering and choking up the pipe. Any water entering the cellar by overflows within the building, or by leakage through the outer walls or through the cellar bottom, will collect in the basin and flow into the pipe, from where it may be pumped through a hose introduced into the head of the pipe at the outside, the cover, I, having been removed from the basin, H. As a material of which to construct the pipe, earthen tile is to be preferred, because of its cheapness and suitability.

There are many advantages claimed for this plan over



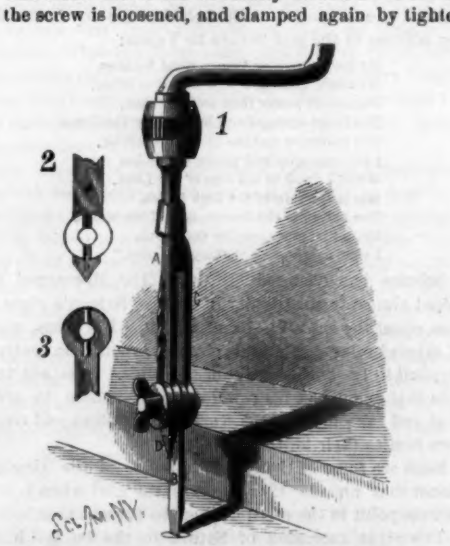
POSZ'S CELLAR DRAIN AND VENTILATOR.

drains connected with a system of sewers; dangerous sewer gases are prevented from entering the house, the walls of the building can be kept in a drier condition; non-liability to choking up under ordinary conditions, and especially so in times of flood, when the filth of sewers is forced back into the connected drains and cellars, to the positive injury of health; complete ventilation is also afforded. This plan will serve well where sewer systems are unknown, as on farms or in small towns and cities.

This invention has been patented by Mr. Michael Posz, of Shelbyville, Ind.

COMBINATION TOOL HOLDER.

The main portion of the holder consists of a blade, A, and a shank formed to fit a bit brace. Upon one side of the blade a clamping plate, C, is attached by a rivet at one end; the outer ends of the two pieces, A and C, are formed with eyes for the clamping screw, which takes a thread in the clamp, C. The clamp is offset to form a space next to the blades, that receives the screw driver, B, when closed, and a gimlet is attached at the other side of the blade, the two tools being upon the screw that passes through eyes in their ends. The eye of the blade, A, is grooved at each side (Fig. 2), and the tools are formed with ribs (Fig. 3) which fit in the grooves when the tools are either in use or turned up. The blade, A, is formed as a countersink, D, below the eye. The screw driver can be readily turned down for use when the screw is loosened, and clamped again by tighten-



SHINE'S COMBINATION TOOL HOLDER.

ing the screw. The driver is out of the way when not in use by being between the clamp and blade.

This invention has been patented by Mr. O. B. Shine, of Covert, Mich.

A GOOD substitute for ground glass is made as follows: Work together equal parts of white lead and common putty until quite soft, then form it into a ball, and roll it over the surface of the glass, and a ground glass appearance is the result.

JACQUELIN AND CHEVRE'S STEAM EXCAVATOR.

In the accompanying engravings we illustrate a new type of excavator which has recently been experimented with at Fleurus, Belgium. It is the invention of two French civil engineers, Messrs. Jacquelin & Chevre. The experiments made with it, in the presence of a large number of engineers, contractors, and builders, gave so satisfactory results that we are warranted in giving a special description of the apparatus.

As well known, the buckets in the different styles of excavators are riveted to the links of the bucket chain, and consequently follow its inclination.

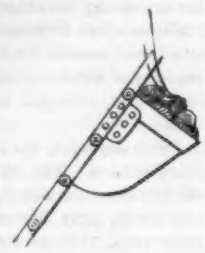


Fig. 5.

When the chain approaches the vertical (Fig. 5), the buckets are in a favorable position, and are capable of holding their contents; but, on the contrary, when it approaches the horizontal (Fig. 6), the material tends to drop out of them. For this reason, dredgers and excavators can perform their full effective duty only when the chain approaches the vertical, as in Fig. 5. For this reason, the excavators that are most employed and give the best results move over the natural ground along the margin of the cutting (Fig. 7). A bucket-frame, A B, whose inclination is varied by means of a jib, carries at its extremity two wheels over which the bucket-chains roll. The buckets empty their contents into a chute, which carries them to the cars. It will be seen that to employ such an excavator the natural ground must be leveled and prepared for the laying of tracks for the apparatus and cars. Now it is only in special cases that the ground permits of such a thing as this, and consequently of the use of this sort of excavator. In sandy regions the giving way of the earth at the edge of the ditch renders its use difficult. Supposing that the ground is naturally even, such apparatus can hardly be used for anything else than widening a trench that has already been opened in order to give the jib a proper inclination. If, in fact, it be desired to attack the ground

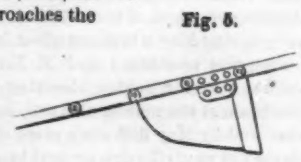


Fig. 6.

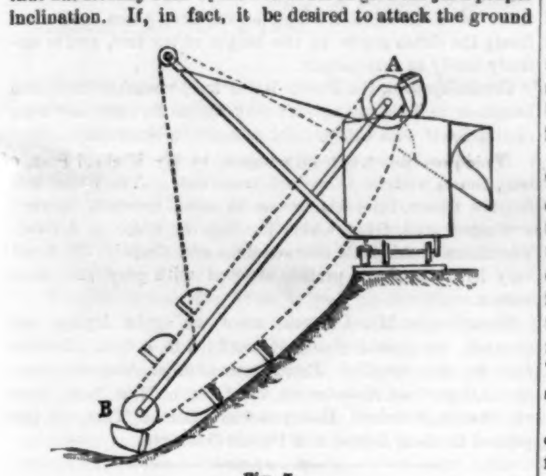


Fig 7.

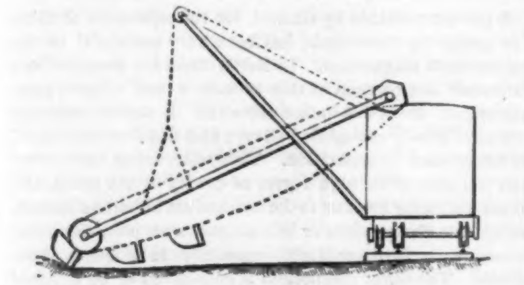


Fig. 8.

before a preliminary trench has been formed, the chain will take the position shown in Fig. 8; and the buckets, being in the position shown in Fig. 6, will lose a large portion of their contents. Supposing that a preliminary digging has been done, and that these apparatus are used as they should be, that is, in the position shown in Fig. 7, the bucket will act only as a consequence of the weight in general of the other buckets and the chain that hangs slack between the wheels. So when the ground is hard the edge of the bucket will slide over the surface, and the bucket will not fill well. The chain, moreover, is necessarily left slack between the bucket-wheels, so that when an obstacle is met with the bucket may jump it. If, in fact, an obstacle be met with at *a* (Fig. 9), the wheel, A, continuing to revolve, the chain, *m n o*, will tend to take the position *m n' o*, and then the bucket can go over the obstacle. It results from this arrangement, which is necessary in these apparatus, that the buckets do not attack the earth well, and that the chain is at every instant tautened and then suddenly slackened. Such shocks cause the material to fall from the buckets, and prove detrimental to their action. So these apparatus do scarcely more than fifty per cent of their effective duty.

As the apparatus just mentioned are scarcely able to operate except for widening, entirely new ones have lately been devised that work on the level of the ground that they are excavating (Fig. 6). These excavators are divided into two categories: those that operate sideways, and those that operate sideways and in a forward direction. The first of these, although ingenious, give but tolerable results, on account of the manner in which the bucket is attached to the chain. In fact, but a slight height can be operated upon under penalty of losing the excavated material *en route;* and if, in order

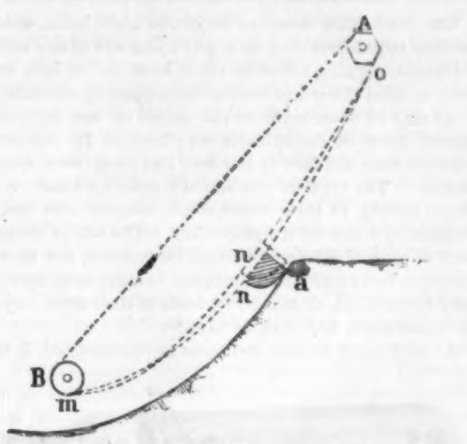


Fig. 9.

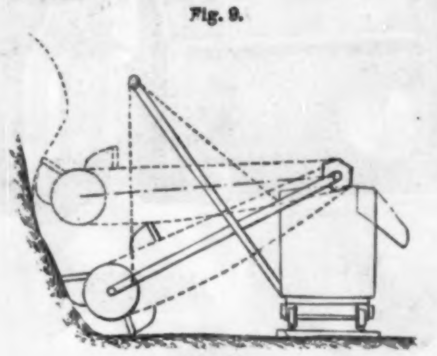


Fig. 10.

to attack a greater height (as is done in practice), we proceed to undermine the earth (Fig. 10), the jib becomes involved in the latter, and the apparatus comes to a standstill. The apparatus of the second category have the same drawbacks, but are nevertheless superior as regards their power of working in a forward direction.

Messrs. Jacquelin & Chevre's jointed-bucket excavator.—This apparatus can be employed in all cases where the exceptional hardness of the ground does not absolutely prevent the use of an excavator. The experiments with it at Fleures showed that it possessed the following advantages: It is capable of working sideways or straight ahead, and of moving over the excavated surface, thus permitting of laying tracks for it and the cars. Its work is continuous. The maneuver of the cars can be effected without loss of time. The arrangement of the bucket permits of excavating at a single operation a trench ten meters in depth.

These and other advantages are due in part to the mode of attaching the buckets to the chain—they, instead of being fixed to the links, being movable around a horizontal steel axis that connects the two chains, and consequently being able to assume different positions that are limited by two stops affixed to each side of them (Fig. 11).

Each bucket has at its lower part a roller that constantly revolves, during the work of excavation, over a strong guide fixed to the jib frame. Each bucket, upon passing over the lower wheel, begins filling, and finishes the operation upon reaching the upper wheel. The T-guide (Fig. 2 M'') terminates above in a cast iron piece which is connected with the axle of the bucket-wheel by means of a bearing, and is so curved that the roller, in revolving over this piece, successively lowers the bucket so as to cause the stops to rest without shock upon the projection of each chain.

When the bucket has reached this position it is carried along to the upper wheel, where, being stopped by the latter, it turns over and empties its contents into the hopper. When this motion has been effected, the bucket rests, through the aid of two projections, upon the links of the chain, and proceeds to the lower wheel to begin its filling anew. To facilitate the discharge of the bucket, and prevent the earth from falling, there is arranged, in front, a piece of plate iron that connects the two chains.

Fig. 11.

The arrangement of the track is shown in Fig. 3. Four cars are always being loaded while four full ones are being hauled away. The earth is successively sent to the right and left by means of a double chute provided with a valve that is actuated by a chain.

In the apparatus under consideration, the buckets have a capacity of 63 liters. The velocity of the chain, in the experiments at Fleurus, was 30 centimeters per second, and 15 buckets passed per minute. Theoretically, then, the apparatus should excavate about 56 cubic meters per hour; but practically the quantity has always been from 60 to 65 cubic meters.

The daily use of this apparatus, including cost of keeping in repair, interest, etc., involves an estimated expense of 90 francs.

Description of Figs. 1 and 2.—*y*, 25 H.P. engine for actuating the buckets and carrier; *e*, engine for actuating the jib and moving the apparatus forward; A, B, C, D, E, frame of the apparatus; W', jib; a^1, bucket attacking the earth; a^2, full bucket on its way to the hopper; a^3, full bucket about emptying; a^4, bucket on its way downward; E', hopper; F', carrier; I'', double chute; M'', bucket guide.—*Le Genie Civil.*

The Direction of the Wind.

That the changing of the direction of the wind is due to the shifting of the situations of greatest heat upon the earth is substantially proved by the fact that in certain regions of the terrestrial surface, where the situations of the greatest heat and cold do not alter the direction in which they lie to each other, the wind does not change, but always blows in the same direction from one day to another, and all the year round. This occurs in the great open spaces of the ocean, where there is no land to get heated up by the sunshine of the day, and to get cool by the scattering of the heat at night. In those spaces, for a vast breadth of many hundreds of miles, the sun shines down day after day upon the surface of the sea, beating the water most along the mid-ocean track which lies most immediately beneath its burning rays as it passes across from east to west. This mid-way track of the strongest sunshine crosses the wide ocean as a belt or zone that spreads some way to either side of the equator. Throughout this midway track the cooler and heavier air on either hand drifts in from the north and from the south, and then rises up, as it becomes heated by the sun, where the two currents meet.

In both instances, however, in consequence of the spinning round of the earth, the advancing wind acquires a westward as well as an equatorial drift. The air current, as it approached the midway equatorial zone, where the onward movement of the sea covered surface of the earth is performed with the vast velocity of 1,000 miles an hour, does not immediately acquire this full rate of speed, and lags back upon the ocean, so that it appears as a drift toward the west as well as toward the equator. On the north side of the equator the wind blows all the year round from the northeast, and on the south side from the southeast, both in the Atlantic and Pacific Oceans. These steady and unchanging ocean winds are called the trade winds, on account of the great service they render to ships carrying merchandise across these portions of the sea. In sailing

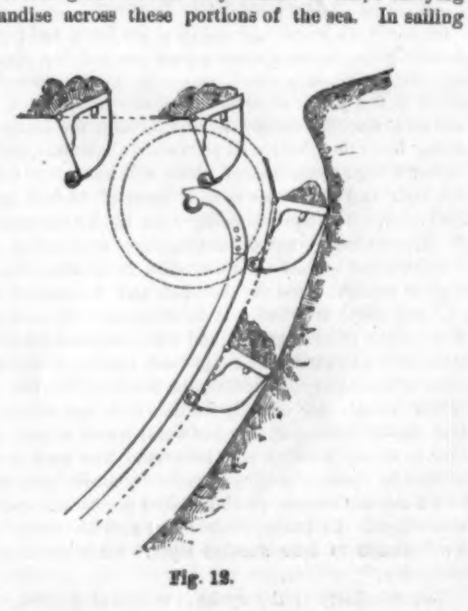


Fig. 12.

from England to the Cape of Good Hope, through the entire length of the Atlantic Ocean, ships, before they reach the equator, have to pass over a broad space where strong winds are always blowing steadily from the northeast. That is the region of the northeast trades. They then traverse a space near to the equator itself, where the northeast winds cease to blow, and where the air is very still and calm, and they afterward come to a region to the south of the equator, where strong winds are continually blowing from southeast. That is the region of the southeast trades.—*Science for All.*

The Precipitation of Gold.

If we compare the various processes for the precipitation of gold, it appears that the method with ferrous sulphate in an acid solution is simple in execution and complete, provided only the solution is free from chlorine, bromine, nitric acid, and from calcium, magnesium, and sodium hypochlorites. This is not the case with the mother liquors of chlorination processes, which may contain all the above mentioned bodies. Ferrous chloride has the same effect, but is dear, easily decomposed, and can be conveyed only in vessels of glass or porcelain. The precipitation with hydrogen is more complicated, as a special apparatus and a temperature of 50° to 60° are requisite. It is, however, applicable in all cases, if no copper is present in the solution. The precipitate settles quickly after the reduction of all the oxidized compounds.—*Chemiker Zeitung, Goethen.*

What Constitutes Good Mortar.*

Machinists and engineers often have occasion to use mortar, and will value the appended information: Good mortar is a solid silicate of lime, that is, the lime unites with the silica or sand to form a silicate of lime. In ancient days those who had some conception of the way the two things united superintended their mixing; but nowadays anybody is supposed to know how to make mortar, while nobody knows much about it. Dry lime and dry sand laid together or mixed and kept dry for a thousand years would not unite to form silicate of lime any more than acetic acid and carbonate of soda dry in a bottle would effervesce. To make silicate of lime just as good as was made by the Romans, all that is necessary is to proceed intelligently: Procure good caustic, *i. e.*, fresh-burned lime, and if you find it all powder, *i. e.*, air slaked, don't use it; use only clear lumps. Slake this (if possible in a covered vessel), using only enough water to cause the lime to form a powder. To this while hot add clean sand—not dirt and loam called sand, but sand—and with the sand add enough water to form a paste. Then let it lie where it will not become dry by evaporation, if in a cellar so much the better; for as soon as you have mixed the sand and lime as above, they begin to react one on the other, and if not stopped by being deprived of moisture will go on reacting until silicate of lime (as hard as any silicate of lime ever was) is formed.

But if you take this so-called mortar as soon as made, and lay bricks with it, unless the bricks are thoroughly wet you stop the formation of silicate of lime, and might as well lay your bricks in mud. Lime and sand, after being mixed, might lie two years with advantage, and for certain uses, such as boiler setting, or where the whole structure of brick and mortar is to be dried, the mortar ought to be mixed for one year before use, and two would be better; but for house building, if the bricks are so wetted as not to rob the mortar of its moisture as soon as used, mortar that has been mixed a month will form good solid silicate of lime among the bricks it is laid with in ten years, and will be still harder in a hundred years. The practice of mixing mortar in the streets and using it at once is as foolish as it is ignorant, and would be no improvement. Silicate of lime is made only by the slow action of caustic lime and sand, one on the other—under the influence of moisture. Dry they never will unite, and mixing mortar as now mixed and using it at once, so as to dry it out and stop the formation that the mixing induced, is wrong.

* *Building and Engineering Times.*

Artificial Stone Masonry.

Of the work which is going on at the Little and Big Gunpowder Falls, on the Philadelphia branch of the Baltimore and Ohio Railroad, there are, says the *Baltimore Sun*, about 10,000 yards of artificial masonry, 7,000 of which will be at the Big Gunpowder and 3,000 at the Little Falls. At the latter there will be 84 piers and 6 abutments, and at the former 6 huge piers, each of which will be 10 feet thick, 70 feet high, and 30 feet wide, with spans of 23 feet between the arches. The work is being done by the Hoopes Artificial Stone, Cement, and Paint Company, of this city.

The field of operations is six miles from Magnolia. The stone is manufactured on the spot, and is moulded in any size and shape required. It is composed of sand, mixed with broken stone or gravel, and with cement and a chemical solution. The process is simple and rapid. Everything is done by machinery, including the breaking of the stones. When the mixture is ready for use, it is run into a square iron bucket, resting upon a hand car, which is then pushed over to where the work is in progress. The bucket is then hoisted by means of pulleys drawn by mules and emptied into a wooden mould, which is placed in position upon a previous layer. In twenty-four hours a fresh stone will be hard enough to bear another layer. Sixty yards are laid every day.

The machinery at the works is valued at $10,000. There are four engines, with ninety-horse power in the aggregate. At the Big Gunpowder Works there is a cable 800 feet long suspended over a deep ravine. It has a car attachment which can be lowered or raised at any point. This car carries stone and other material across the ravine. The cable was formerly used in the construction of the famous Brooklyn bridge. When stones are to be laid in the water-course, the water is first dammed and then bailed out. The work is going on day and night, one gang of men succeeding another. Thirty men are employed. Electric lamps light up the scene and give the place an oddly picturesque appearance. The masonry will be finished about the middle of December.

Each pier and abutment is really one solid stone, but for the purpose of giving it a finish it is moulded with grooves so as to resemble stone in blocks. Its monolithic character will be a great advantage in railroading, as it will prevent that jarring and rebounding which is always caused by trains running over tracks laid upon stone or brick foundations.

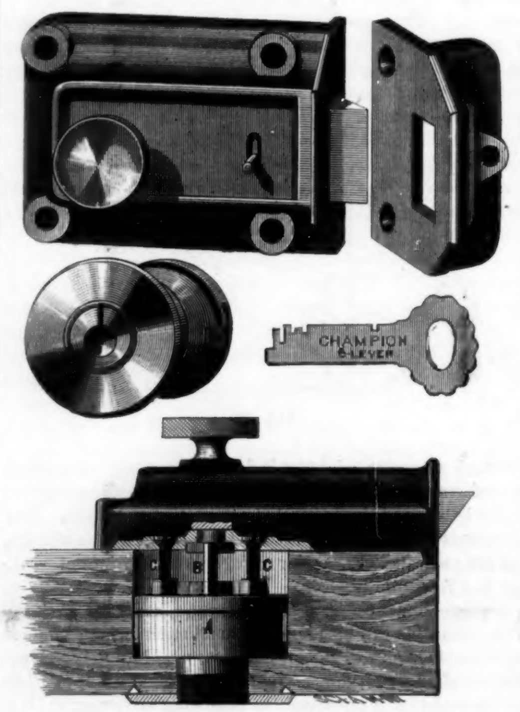
It is believed by many persons that the art of making artificial stones is prehistoric, and that the Pyramids were built of artificial blocks manufactured from the sands of the surrounding plain. In modern times a Frenchman named Coignet has accomplished some wonderful work with artificial stone. The most important and costly work that has yet been undertaken with Coignet's material is a section three miles in length of the Vanne aqueduct for supplying water to the city of Paris. Another interesting application of this material has been made in the construction of the lighthouse at Port Said, Egypt. It is 180 feet high without joints, and resting upon a monolithic block of beton, containing nearly 400 cubic yards.

THE "CHAMPION" SIX-LEVER RIM NIGHT LATCH.

Our illustration shows an improved night latch, which by an easy adjustment may be applied to doors of any ordinary thickness, opening either to right hand or to left, and to such as open inward as well as those opening outward.

As may be observed from the design of the key, the essential parts of the cylinder are placed as far removed as possible from the face of the door and from view from the outside. The cylinder contains six rotating disks or tumblers, having in their outer edges notches that may be brought into line by the proper key. The whole circumference of each disk being available for notches, the manufacturers have no difficulty in making as many combinations as may be required, so that no two sets of their latch keys will be found alike, unless made to order.

As most other latches and locks are constructed, it is well



"CHAMPION" SIX-LEVER RIM NIGHTLATCH.

known that they may be "picked" by any contrivance that will bring a strain upon the key hub or upon the bolt, and then picking up the tumblers in turn. This theory of picking is not applicable to this latch, because the key hub and tumblers all rotate freely, so that a strain cannot be brought upon them.

In view of the earnest and costly efforts by prominent manufacturers in both England and America, who have devised so many hundred different forms of keys, and of difficult keyholes, so many "wards," "drill pins," and the like, to cover over the weak spots in their locks, it seems strange that the chief defect should have been so long retained even in locks of high pretensions. But, in spite of the corrugated and complicated key and keyholes, in every instance in which a strain can be made to bind one or more of the tumblers, it is learned, sooner or later, and at the expense of consumers, that such locks cannot afford that degree of security nowadays required.

The principle applied in this latch is not a new principle of security. It has been used by the same manufacturers in their "Champion" six-lever padlocks, whose reliability is so well established that they have been adopted and for several years largely used by the treasury departments of the United States and of other governments, and have acquired more than a national reputation.

The escutcheon of the Champion latch is screwed upon the nosing of the cylinder, and is held in place by suitable claws upon its inner face. This method of securing the escutcheon permits an adjustment, adapting the cylinder to the thickness of the door, and thus renders it a very easy latch for the carpenter to put on.

For prices and further particulars see manufacturers' card, page 349 of our advertising columns.

Separation of Wool from Cotton.

Heddebault has succeeded in separating rags of cotton and wool, mixed, by subjecting them to the action of a jet of superheated steam. Under a pressure of five atmospheres, the wool melts, and sinks to the bottom of the receptacle; while cotton, linen, and other vegetable fibers stand, thus remaining suitable for the paper manufacture. The liquid mud which contains the wool thus precipitated is then desiccated. The residue, which has received the name of azotine, is completely soluble in water, and is valuable on account of its nitrogen. Moreover, its preparation costs nothing; because the increased value of the pulp, free from wool, is sufficient to cover the cost of the process.

Ornamental Hardy Shrubs.

After an experience of fifteen years with a great number of shrubs, Editor E. S. Carman recommends, in the *Rural New-Yorker*, the following as the best for the average country home:

Viburnum plicatum should be mentioned among the first as one of the most valuable and beautiful flowering shrubs, far surpassing the older varieties of Snowball.

Chionanthus Virginica, White Fringe, is a native shrub or small tree, notable for its large leaves and graceful, drooping panicles of slender-petaled flowers that seem almost to float in the air, so slight are the pedicels which hold them to stems.

Pyrus Japonica, the Japan Quince, should find a place in every garden. The leaves are ever bright and glossy, while the blossoms are almost unequaled for brilliancy by those of any hardy, early blooming shrub. The range of colors is from white through rose to dark red. In clumps or small clusters composed of several or all of the different colors, we have during May a brilliant effect indeed.

Forsythia viridissima and *F. Fortuneii*, Golden Bell, are the finest of the golden blooming shrubs. They begin to bloom about the middle of April, before the green leaves appear, and by May first are a mass of bright yellow. These plants are very effective trained to a single stem. Fortune's Golden Bell bears flowers rather larger in size and a few days earlier than viridissima.

Hydrangea paniculata grandiflora, the Great Panicled Hydrangea, has proved very hardy. Its panicles of sterile flowers are often a foot or more in length, changing from a greenish white to pink as the nights grow cold. It is a coarse but showy shrub.

Spiræa prunifolia, the Double Spiræa, commonly called Bridal Wreath. The little double white flowers appear in late May, and soon the shrub becomes a mass of white, which lasts until June.

Spiræa Thunbergii is one of the first of all hardy shrubs to bloom. It is a small bush, bearing white blossoms in great profusion.

Deutzias and *Weigelias* in variety may be selected from nurserymen's catalogues, since there is no great choice between them. All are pretty and floriferous.

Exochorda grandiflora bears white flowers resembling those of Crab Apples. The leaves keep green until after frost; the shrub grows to the height of ten feet, and is entirely hardy in this climate.

Cercis Japonica, the Japan Iudas tree, wreathes its naked branches in late spring with rosy purple flowers, and later clothes itself with shiny, thick leaves of a heart shape.

Halesia tetraptera, the Silver Bell, is a well shaped little tree, found wild in Ohio and southward. The white bell flowers droop from the stems in small racemes, leaving a winged seed, from which the specific name is derived. The stems of this little tree are clean and shapely, the wood very hard, the bark prettily striated with gray and dark brown.

These, says Mr. Carman, were we again laying out grounds, we should choose if confined to a few. For the rest, we may mention *Pavia macrostachya, Stuartia penagyna, Hypericum Kalmianum*, the Golden Nine bark, Rose of Sharon, Standard Honeysuckles, Smoke Tree, the improved kinds of Lilacs, and Purple Barberry.

Preparation of Magnesium.

A process patented by Gratzel, for the separation of alkaline metals by electrolysis, has been very successful in the reduction of magnesium. In Berlin there has recently been exhibited, as a product of this process, a ball of pure magnesium, of about five inches diameter. It was exceedingly brilliant, closely resembling silver; and had lost nothing of its luster since its separation. This preservation from corrosion is a sign of the high degree of purity of the metal, and forms a striking contrast to the magnesium hitherto obtained, which was always more or less alloyed with potassium, and consequently easily oxidized, especially in a damp atmosphere. The purer magnesium is considered to be destined to increasing maritime use, because the rays of the magnesium light appear to have a greater penetrative power in fogs and mists than the electric arc.

A New Hydrocarbon Mineral.

A new mineral hydrocarbon has recently been discovered near Seefeld, in the Tyrol. It occurs crudely in the form of a bituminous rock, of peculiar constitution; and the bitumen is believed to be composed of the decomposed remains of prehistoric marine animals. Treated with strong sulphuric acid, the bitumen yields a soft substance, which when neutralized is not unlike vaseline in consistence, but resembles coal tar in color. It differs from all known vegetable and mineral tars, however, by its odor, and by the possession of peculiar physical properties. It forms an emulsion with water; and is partly soluble in alcohol and ether. A mixture of these two liquids completely dissolves it. It is miscible in all proportions with vaseline and oils. The name "ichtyol" has been given to the substance, which is characterized above all by its richness in sulphur, of which it contains about 10 per cent. This element is so intimately mixed with the ichtyol that it can only be separated by the complete decomposition of the latter. Besides sulphur, ichtyol contains oxygen, carbon, hydrogen, and traces of phosphorus. In consequence of the high proportion of sulphur, the new hydrocarbon is regarded hopefully as a medicament or unguent.

Correspondence.

Starving and Washing Away Rheumatism.

To the Editor of the Scientific American:

In your last issue I find something about starving and washing out rheumatism by extreme exposure. I was a farmer lad in fall of 1850, living near Ottumwa, Iowa. The ague had fastened itself upon me so firmly that every now and then, in spite of various antidotes, I would be visited by a series of too familiar shakes. One afternoon I was hauling saw logs with an ox team, and, the roads being heavy from recent rains, wagon got stuck ascending a hill. Became so engaged in efforts to overcome the difficulty that I failed to take note of an approaching storm simultaneous with a severe chill of the ague. The situation of the team was such that I did not dare leave it, and the result was that the most furious rain storm that ever was experienced broke upon me; and while the rain pelted down I thought I never before realized so severe a chill of the ague. The drenching was so thorough, there could not be found upon me a dry thread, and the duration of the chill was prolonged to that pitch that I thought I would perish then and there. Fortunately a team came along after the storm passed over, picked me up, and took me home. The ordeal was a severe one, but from that day to this, including three years' service at the front in the late war, I have not experienced any symptoms of the ague.

J. W. NEIGHBOR.

Phelps, N. Y., Nov. 10, 1884.

[Although this correspondent survived his heroic treatment, we would not advise others to try the same mode of cure. It might be death to them.—ED.]

Atropos.

To the Editor of the Scientific American:

I send by this mail a small phial containing some insects that infest houses here, getting under the carpets and into beds. You will see millions of them in a single bed. Will you please inform me what is the name of the insect, whether they do any damage to the bedclothes, where they come from, and how to exterminate them?

REAL ESTATE JOURNAL,
per J. B. PARKER, *Publisher.*

Nashua, N. H., Nov. 4, 1884.

We submitted the specimens to Prof. C. V. Riley for examination, who writes as follows:

To the Editor of the Scientific American:

The insects which you submit to me, sent by Mr. Parker, publisher of the *Real Estate Journal* at Nashua, N. H., prove on examination to be a species of *Atropos*, but the habits of the species as given by Mr. Parker are certainly exceptional and most interesting. The habits of the family (*Psocidæ*), so far as known, are as follows:

Atropos divinatorius Fabr. is one of the worst museum pests, quite injurious to the more delicate parts of preserved insects, and especially the smaller lepidoptera. It is also more or less injurious to old books. The same habit is also possessed by the well known *Psocus domesticus*. Another species, undetermined as yet, I have found caught in great numbers in bird lime used for the purpose of trapping winged *Phylloxeræ*. Another species of *Atropos*, probably *pulicarius*, has been found by Miss M. E. Murtfeldt, of Kirkwood, Mo., infesting the egg mass of the cottony maple scale (*Pulvinaria innumerabilis*). Another species, which corresponds to *pulsatorius*, has been found in large numbers in preserved corn in the museum of the Department of Agriculture, many of the kernels being eaten out entirely. I cannot imagine that the species sent by Mr. Parker can in any way injure the bedclothes, nor can I state, without knowing more of the surroundings, whence such numbers come, nor suggest any mode of exterminating them other than cleanliness, and especially the riddance of any dry animal or vegetable substance in the house.

C. V. RILEY.

Department of Agriculture, Bureau of Entomology,
Washington, Nov. 13, 1884.

The American Electrical Exhibition, Boston.

As will be seen by reference to our advertising columns, the date of opening this exhibition has been postponed one week, to Dec. 1. It is intended to make this exhibition as complete and comprehensive as possible in every particular, in the interest of science and education in the electrical and mechanical arts, and to present therein a comprehensive view of the recent great progress in practical applications of electricity. The building in which the exhibition is to be held, that of the Massachusetts Charitable Mechanic Association, on Huntington Avenue, is one of the finest in the country for a display of this kind, and the management is of a character which gives every assurance of success.

Progress of Photography.

A recent number of the *Photographic News* contains a reproduction of a photograph of the Paris express train taken by an exposure of the entire plate for one three-hundredth part of a second—a side view, while the train was running at a velocity of forty-two miles per hour. There is a slight blurring in some of the details of the picture, but in general it looks as if the cars and locomotive were standing still.

IMPROVED STEAM WHEEL.

The accompanying engraving represents a simple and effective motor, actuated by either steam, compressed air, or water, and which consists of a wheel having a hollow rim open at one side, and containing a series of pistons adapted to slide through a segmental casing fitted to the rim and pistons, and serving to confine the steam. Mounted upon the shaft, B, is the spider, A, to which the hollow rim is attached. The ring is composed of segments fitted end to end and secured together by bolts, each segment being secured centrally to an arm of the spider. That side of the rim opposite or remote from the spider arms is open, and the peripheral side is flared or beveled outward, and is only about half the width of the inner side. In the angle of the rim is secured a series of pistons, D, having V-shaped outer ends. A case, E, having the same curvature as the rim and fitted to the plane and V-shaped sides of the pistons, is provided with ears which support it in such relation to the rim as to form a closed curved chamber through which the pistons may pass.

The V-shaped outer edge of the casing, E, passes between the beveled part of the rim and the pistons, making a steam-tight joint (this construction is clearly shown in the small cut, which is a cross section through the rim). The casing, E, is provided with a double nozzle, H, each provided with a stop valve, by which the amount of steam admitted can be regulated. Steam, air, or water impinging on the pistons drives them forward in the segmental casing, E, and when they arrive at the end of the segment the steam escapes. As

LALIBERTY'S IMPROVED STEAM WHEEL.

may be easily perceived, this motor may be put up to run in either direction.

Great speed is possible with this motor, and the advantages derived from applying the power at the periphery of the wheel will be apparent.

This invention has been patented by Mr. Homer Laliberty, of Blackfoot, Idaho.

Sir Moses Montefiore.

Well done, Sir Moses Montefiore! It may now be hoped that we have heard the last of the opinion that in modern times no human life has been proved to reach 100 years. With the extending term of human life and the steady improvement in human habits, life has often seemed to reach 100 years and more. But this has not frequently been the case in persons whose history was so well known as that of Sir Moses Montefiore. He was born at Leghorn on October 24, 1784, whither his parents had gone on a business journey. His birth was duly entered in the books of the Spanish and Portuguese synagogues in Bevis Marks. It is a grand thing to live to 100 years and to be still cheerful and thankful. It is so, in the first place, for the pleasure of rebuking such skeptics as Sir George Cornewall Lewis, and in the second for the pleasure of giving all men proof that there is nothing in physiology to make it impossible for them to achieve a century of honorable and agreeable existence. We do not wish to magnify mere longevity, or to make every man believe that by any amount of thought he can necessarily attain to it. Our study of longevity leads us to think that it is generally a constitutional, and often a hereditary, matter. It is more important to live well than to live long.

"Nor love thy life, nor hate; but what thou livest
Live well; how long or short permit to Heaven."

It is in this spirit, and doubtless largely because of this spirit, that Sir Moses has attained to his 101st year. It should not be forgotten that in the last decade of it he accomplished no less a feat than a journey—the third he had made—to Palestine. And it is only by so "living well" that any one is likely to attain to an enjoyable and unselfish old age. Living well in the vulgar sense of the word is one of the surest ways of failing of this achievement. There are a few men whose powers of vitality and whose integrity of tissue are so exceptional as to enable them to almost disregard the laws of health; and their survival to a high age often leads careless observers to wrong conclusions; but there is nothing more certain than that for Jew or Christian—and Sir Moses shows how much there may be in common between a good Jew and a good Christian—the great secret of longevity is to "live soberly, righteously, and godly."—*Lancet.*

Improved Developer for Gelatine Plates.

At a recent meeting of the Society of Amateur Photographers in this city, Mr. H. J. Newton gave the following formula for a developer well adapted to bring out fully the details in a plate which has had a very short exposure:

No. 1.

Water	1 ounce.
Carbonate soda	15 grains.
Yellow prussiate potash	15 grains.
Sulphite of soda	5 grains.

No. 2.

Water	1 ounce.
Chloride of ammonia	7 grains.
Pyro (dry)	6 grains.

Nos. 1 and 2 are mixed, and the whole poured over the plate. Development commences within a minute, and is usually finished at the end of three or four minutes. The proportions named above are correct for an ordinary drop shutter exposure, but they are not arbitrary; they may be varied to suit different cases, as, for example, should the plate have been greatly underexposed, equal parts of Nos. 1 and 2 (with the pyro left out of the latter) may be added, a little at a time, to from three to four times the strength stated, until all the details in the shadows are brought out, without danger of producing green fog, which frequently appears from the excessive amount of ammonia sometimes used in the ordinary ammonia and pyro developer. In case of overexposure, half a grain to the ounce of developer of bromide of sodium is added, and the solution diluted with water.

Nos. 1 and 2 solutions may be kept in a more concentrated form, and diluted for use. The following are the right proportions for 10 per cent. solutions:

No. 1.

Water	9½ ounces.
Carbonate soda	480 grains
Yellow prussiate potash	480 grains.
Sulphite soda	160 grains.

No. 2.

Water	9 ounces.
Chloride of ammonia	510 grains.
Solution of one drop of sulphuric acid in one ounce water	1 drop.
Pyro (1 commercial ounce)	437 grains.

If No. 2 does not change from a purple color to a clear yellow color within an hour after mixing, one or two drops more of the sulphuric acid solution may be added.

To prepare a developer of the proper strength with the above solutions for the development of a 5 x 8 plate which has had a drop shutter exposure take:

Water	5½ drachms.
No. 1 solution	2½ drachms.

Also:

Water	7 drachms.
No. 2 solution	1 drachm.

Mix the two, and develop in the usual way. The proportions given will be equivalent in grains to those stated in the first formula.

Mr. Newton described some interesting experiments, which substantiated very forcibly the value of the developer for instantaneous work. Two plates exposed precisely the same time, on the same object, were developed side by side, one with the developer as prescribed in the directions of the manufacturer of the plate, and the other with the above developer. With the ferrocyanide there was from a half to a third more detail brought out in the shadows, and development was completed sooner than with the prescribed developer; the negatives being more brilliant and vigorous.

Plates were shown which had been kept for some time, in which was seen the marking of the dividing mat, and a general fogginess proceeding from the same cause. Mr. Newton had discovered that by adding a small quantity of bromide of sodium—half a grain to the ounce to the developer—all traces of fogginess and all indications of metallic silver disappeared—the plates developing clear and free from such defects. He advised the use of the above remedy where plates affected as described were discovered. His theory of the developer was, that when the chloride of ammonia or No. 2 solution was mixed with No. 1, the chloride of ammonia was decomposed, ammonia being liberated, which, acting in conjunction with the yellow prussiate of potash and carbonate of soda, produced an extremely powerful developing agent, while the chlorine liberated from the chloride of ammonia acted or seemed to act as an agent to prevent the discoloration of the film.

Mr. W. E. Partridge showed two negatives which he had developed with the developer, which were very clear and of excellent printing quality. He was much pleased with the working of the developer. Mr. F. C. Beach stated that he had also tried the developer, with satisfactory results. It acted very quickly, kept clear, and was of a light straw color by daylight when first mixed, afterward turning to a cherry color. Free ammonia was easily perceived, showing that the action was similar to Mr. Newton's explanation.

Two negatives were shown by Mr. Beach which had had extremely short exposures; one was developed with the formula as given, and was of a dense greenish yellow color, the other by a modification consisting of the use of a sulphurous acid sulphite soda solution of pyro in place of dry pyro, as advised in No. 2. It had a clear, grayish wet-plate appearance, and, in his opinion, developed up better, although somewhat slower. In each case an equal amount of detail was brought out in the shadows. A sample of the developer was shown, after it had been used in the development of two plates and had been standing for twelve hours; it was clear, but of a sherry color.

AERIAL NAVIGATION.

BY VICTOR TATIN.

The purely mechanical solution of the problem of aerial navigation has been sought through three means—helicoptera, or large helices with vertical axes, imitation of the natural flight of birds, and aeroplanes moved by helices with horizontal axes.

Helicoptera.—The first helicopteron that was able to sustain itself in the air was that of Lannoy and Bienvenu, and dates back to 1784, the epoch at which it was presented to the Academy of Sciences. The necessary motive power was furnished it by a bow of whalebone. At that time a practical solution was far from being reached, and the apparatus just mentioned awaited improvement for more than three-quarters of a century. It was then that an ingenious experimenter, Mr. A. Penaud, happily modified it by substituting a twisted rubber thread for the spring. This apparatus gave results so superior to those that had before been obtained that it might almost have passed for a new creation. But despite the efforts of Penaud and a number of other investigators, it was impossible to devise any practical result from the helicopteron, and the little machine became an interesting plaything, and that was all.

The only apparatus of the kind that has since been constructed is Mr. Forlanini's helicopteron. This experiment was made upon a little larger scale. The springs were replaced by a small and very light steam engine, whose boiler consisted of a vessel filled with water raised to a high temperature. The whole weighed 6¼ pounds, and rose in the air when the engine developed a one fourth horse power, or one horse per 26 pounds. In spite of all the interest that such an experiment presents, we cannot prevent ourselves from remarking that the disposable weight was very feeble in proportion to the considerable work demanded of the engine. Notwithstanding the contrary opinion of many persons, we shall demonstrate without trouble that we can, by means of a helix, obtain much more favorable results. The experiments which we take for a basis were, like those of Mr. G. Tissandier, performed with helices which, through their very construction, did not possess a maximum of sustaining power. They were not constructed, as in Mr. Forlanini's apparatus, in view of a recoil of about 100 per cent. Every helix, in fact, should be carefully studied from the standpoint of what we expect from it. So, in the helicopteron, as the helix is at the same time a sustaining plane, it should be likened to a surface moving horizontally, and in which, consequently, the resistance to motion will be to the lifting power as the sinus is to the cosinus of the angle formed by such plane with the horizon. Should we construct, then, a like helix of sufficiently short pitch and of wide surface, we might theoretically, and by pushing things to the extreme, lift an indefinite weight with a very slight power, and we should be limited only by passive resistances and friction. When, on the contrary, the helix, instead of being stationary, or nearly so, is destined to have a motion in the direction of its axis, it can be given a longer pitch, since it then attacks the air at an angle that is so much the smaller in proportion as the recoil is less. It is thus situated under as favorable circumstances as one with a very short pitch, whose recoil is 100 per cent. We think the detractors of the helix have not understood this condition.

However this may be, it seems to us that the helicopteron system has indeed but little future before it, because of the extreme lightness that it would be necessary to give the immense structures whose every part would be in motion. Besides, we may ask, What velocity would we obtain, since we would have here only one means to employ—that of inclining the rotary axes of the helices? To make use of secondary helices would evidently be a complication as compared with the use of the aeroplane. What also would be the relative immobility of the car suspended from the axes of two helices revolving in opposite directions? These questions are not as yet answered.

Mechanical Birds.—The imitation of nature must have always seemed to man as the most rational means of artificially solving the problems that she herself has worked out, and we find a proof of this in some old mythological fables whose origin is lost in the depths of time. Among the attempts that have been made since, none has given a real result, and we are scarcely more advanced to-day than they were in the

Fig. 1.—TOY HELICOPTERON.

time of Archytas of Tarentum. It is again to Mr. Penaud that we owe the first important results in this path—the most arduous that we could select in order to reach success with apparatus heavier than air, and the one in which we are most backward. When Penaud, through the use of twisted

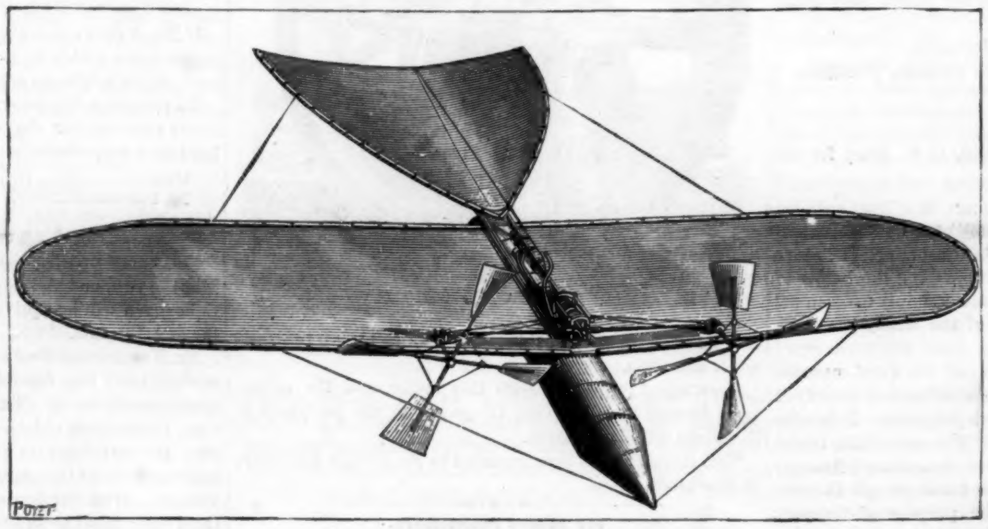


Fig. 2.—TATIN'S AEROPLANE.

rubber, caused a small machine to fly, our emulation was excited, and no one perhaps was more enthusiastic than we in the pursuit of a definite result.

During the course of our researches, which lasted for several months, we constructed a large number of mechanical birds of all sizes and various weights, from that of half a gramme up to that of more than a kilogramme, and reaching in the latter case a spread of wings of more than two meters. In our smallest models the rubber spring was always used, but we varied the form and relative extent of the wings *ad infinitum*, as we did the number and amplitude of their strokes. We compared the advantages and disadvantages accompanying the use of wings of birds or cheiroptera, and finally we obtained results that have never been surpassed, nor even reached, but always by exceeding a power that was out of proportion to the effect obtained. We afterward tried to find as exactly as possible the value of this excessive expenditure, by constructing compressed air machines designed to replace the rubber. These apparatus were the largest that we experimented with, and their extreme lightness permitted us to furnish a mechanical bird nearly ten times its weight in kilogrammes per second.

After modifications without number, and entire or partial reconstructions, the results were so unfortunate that we had to give up the struggle, at least in this direction. Is that to say that a mechanical bird is a machine impossible to realize? In no wise; we must not conclude from our defeat that better cannot be done, but we shall not advise any one to try it with a view to obtaining a practical result in aeronautics. The very complex motions of a bird's wing during flight are very difficult to imitate in mechanics, and, if nature has used them, it is because the organs of these animals could not adapt themselves effectively to other and simpler motions that mechanics make use of—rotary motion, for example. It will be thought, perhaps, that we have been a pretty bad mechanic. We admit this very willingly, but at present we are convinced by force of time and money that the imitation of nature has no other interest than that of making us better understand the means that she employs. It seems to us inadmissible to construct a mechanical bird in order to navigate the air. Our fathers did not try to construct the locomotive after the type of the hare or antelope in order to imitate the speed of those animals.

Aeroplanes.—By this name are designated apparatus whose invention is quite recent, since the first rational project published about them is due to Henson, and dates back to 1842 only. This, moreover, is the type that has always been reproduced since then. The principle of this apparatus consists in the maintaining in air of a vast plane, to which propelling helices communicate a rapid forward motion. No one that we know of had obtained good results by means of these apparatus before Penaud, who again employed twisted rubber for setting these small and astonishingly simple apparatus in motion. This ingenious experimenter unfortunately devised nothing but types of aeroplanes of small dimensions. The disease that was to remove him from us doubtless interfered with his researches.

A few years before his death he published, in conjunction with one of our friends, Mr. P. Gauchot, a project for an aeroplane of large dimensions, but his demise prevented its being carried out. This construction would doubtless have entailed quite a heavy expense, but we believe that it would have given a victorious proof of the superiority of the aeroplane over all the apparatus that we have described above. At the epoch at which Penaud definitely devoted himself to the use of the aeroplane as the most capable method of giving practical results, we were still engaged in constructing apparatus based upon the imitation of the flight of birds. Our eyes were finally opened to the evidence, and we entered a path which since then we have not ceased to follow. We soon congratulated ourself upon this change, for, from the very time of our first trials, the results have been satisfactory.

Fig. 3.—EXPERIMENT AT CHALAIS-MEUDON.

A small aeroplane of about 0·7 square meter surface was actuated by two helices that revolved in opposite directions. The motor was a compressed air machine analogous to a steam engine, whose boiler was replaced by a relatively large receptacle of 8 liters capacity. Despite the little weight that we could dispose of we were, nevertheless, enabled to give the receptacle sufficient strength to cause it to resist, on trial, more than 20 atmospheres (in our experiments the pressure never exceeded 7). Its weight was only 700

grammes. The little engine, which developed a motive power of about 2 kilogrammeters per second, weighed 300 grammes. Finally, the total weight of the apparatus, mounted upon rollers, was 1·75 kilogrammes. This entire affair (Fig. 2) left the earth at a velocity of 8 meters per second, although the resistances were almost equal to those due to the opening of the angle formed by the planes above the horizon. The experiment was performed in 1879 at the Chalais-Meudon Military Establishment. The aeroplane, which was attached by a cord to the center of a circular flooring, revolved around the track, rose from the ground, and once, even, passed over the head of a spectator (Fig. 3). We can only renew here the thanks that we have already addressed to Messrs. Renard and Krebs for their extreme obligingness and the interest which they appeared to take in our experiments.

After this result we formed a project of studying with this apparatus the advantages or disadvantages connected with the use of more or less extended planes, of more or less open angles, and of different velocities in the two cases; but our resources, which were then more than exhausted by these long and costly labors, did not permit it, and, to our great regret, we have since had to content ourself with indicating *the* programme of our experiment, without carrying it out ourself.

The experiment which we have just described confirmed our previsions, however, and we think that we are now able to trace the principal lines of an aeroplane without fear of committing a grave error. In an aeroplane, as in a balloon, the resistance to a forward motion increases as the square of the velocity. The motive power, then, will here also have to increase as the cube of such velocity; but since, for a given angle that is supposed invariable, the sustaining thrust and the resistance to motion will always be in the same ratio, the disposable weight will increase with the square of the velocity, so that, as regards this point, we will be more favored than by the use of balloons.

It must be remarked, per contra, that, with the aeroplane system, large constructions will merely offer the advantage of permitting us to obtain motors that are relatively lighter and more economical.

It is very evident that the first essays made with aeroplanes would be only of short duration. Let us at first have modest views. Let an aerial machine work only an hour, half an hour even, at a velocity of 15 meters per second, and the progress made will be immense; one may even say that the problem will be entirely solved. After this first step will rapidly come the improvements that experience will indicate. New motors will become an object of researches that will soon prove fecund, and humanity will finally find itself in possession of the most powerful engine that it has ever imagined.—*La Nature.*

CHOLERA has prevailed in this country in 1832, 1848–49, 1854, 1865–66, and 1873.

DINOSAURS.

The first naturalists who described reptiles as crawling animals would certainly have modified the opinion that they expressed had they known the strange creatures whose history we are about to sketch.

These animals, which are designated as ornithoscelians or dinosaurians, partake, by certain characteristics of their organization, of the nature of mammals, birds, and reptiles properly so called, while at the same time exhibiting characters that are proper to themselves. They seem to bridge over the gap which in present nature separates the most perfect of the reptiles, the crocodiles and the tortoises, from the lower mammals—the marsupials—and from such birds as the ostrich, emu, and cassowary. They are so far removed from the reptiles that we have to form a distinct subclass for them equal in value to that which is admitted for reptiles of the present time.

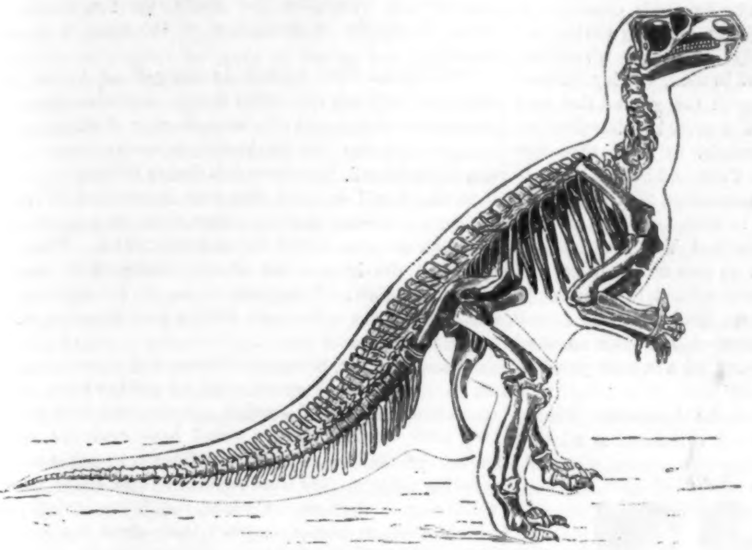


Fig. 5.—SKELETON OF IGUANODON.

The differences that they present from our reptiles are much greater than those that we find between tortoises and serpents, for example, to merely cite the two extreme terms of the series. We know nothing of the dinosaurs except their skeleton. It is probable that if it were permitted us to know what their organization was, how their circulation was effected, and what their mode of development was, we should not hesitate to put them into a class intermediate between that of the mammals and birds and that of the reptiles properly so called. It was along toward 1820 that Gideon Mantell found the first bones of dinosaurians in the midst of Tilgate forest, on the Isle of Wight, in strata which are referred to the lower portion of the Cretaceous formation, and which are terrestrial and fresh water ones that mark a transition from the Jurassic to the Cretaceous. These bones, which were very incomplete, were referred by Mantell to an animal of great size, which he called an *iguanodon*, as the teeth offered certain analogies, as regards form, with those of a lizard of the present time called the iguana. Since that epoch, and especially since a few years back, our knowledge concerning the dinosaurs has peculiarly increased, and we are beginning to get a glimpse, among these animals, of very different types, which indicate orders just as distinct as are those of the pachyderms, ruminants, and carnivora among mammals.

Upon the sides of the Rocky Mountains, in the United States, we find strata which can be followed for several hundred miles in extent, and which have yielded for the investigation of paleontologists a small marsupial, remains of fishes, remains of pterodactyls, crocodiles, and tortoises, and especially an enormous quantity of bones of gigantic dinosaurs. We have here a true bone yard in which lie buried, pellmell, the most curious and strange forms of all the animals that the ancient ages have bequeathed to us. It is to the admirable researches of Marsh and Cope that we owe our knowledge of a fauna that has entirely disappeared.

Fig. 1.—TOOTH OF MEGALOSAURUS.

Fig. 2.—TOOTH OF IGUANODON.

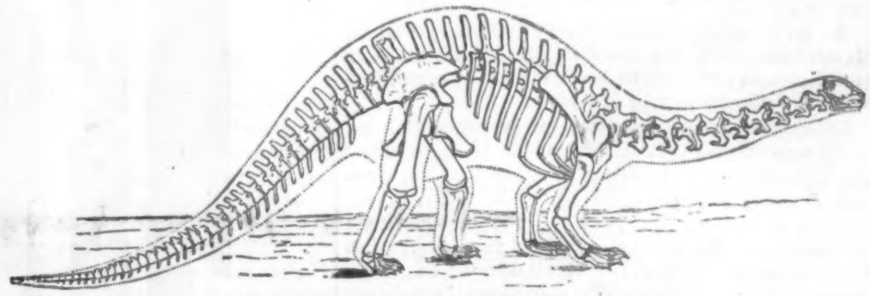


Fig. 4.—SKELETON OF BRONTOSAURUS (× 1-125).

Guided by the two great laws of correlation of forms and subordination of characters—laws which we owe to the incomparable genius of Cuvier, and which, like Ariadne's thread, permit us to find our way in the inextricable labyrinth that is presented by the forms of extinct animals—these two learned American paleontologists have evoked an entirely new world, and brought up before us the evidences of a fauna of which nothing in existing nature could have given us the least notion.

During the secondary epoch the dinosaurs lived also in Europe and in Southern Africa, where they were represented by very diverse types, as has been shown us by the learned researches of Mantell, Owen, Phillips, Huxley, Seeley, Hulke, Dollo, and Matheron.

Very recent researches have thrown an entirely new light upon the organization of these animals, and permitted of as complete a study of their skeletons as could have been made of those of animals now living. We can grasp the general features that connect them with other reptiles, and the peculiar ones that distinguish them from each other.

What essentially separates the dinosaurs from all other reptiles is that the sacrum is always composed of more than two vertebræ, which form a very solid, single bone like that of mammals. These vertebræ, which exceed the normal number of two, are caudal ones that are modified so as to serve as a support of the pel-

Fig. 3.—AMERICAN LANDSCAPE OF THE JURASSIC EPOCH WITH REPTILES AND PLANTS OF THE PERIOD.

vis, which is considerably enlarged, in order to be able to support the usually robust hind limbs. To judge by the great width presented by the medullary canal, the spinal marrow must have been much swollen in the sacral region, and have furnished very large nerves to a limb that was strongly developed and moved by extremely powerful muscles.

The ribs are highly developed, and their size shows that the thoracic region was very ample, and that consequently the lungs must have been large.

As the food of the dinosaurs was very varied, the form of their teeth is, as may be seen, entirely different according to the types examined. The flesh eaters, such as the megalosaurus (Fig. 1), had strong, cutting teeth, which were crenulate at the edges. The maxillaries, as well as the intermaxillaries, were armed with such teeth, and these must have been formidable. The herbivora, such as the iguanodon (Fig. 2), the vectisaurus, the laosaurus, and the hypsilophodon, had maxillaries that were provided with teeth admirably arranged for cutting and grinding. These teeth became worn out, like those of existing herbivorous mammals, and were indefinitely replaced, that is to say, as soon as one of them was worn out, another one succeeded it. What is not found in existing reptiles was a motion of the jaws, as in the ruminants of our epoch, in order to allow the teeth to grind food. The size of the apertures and channels through which the nerves passed shows that there existed soft lips and cheeks, without which the mastication of food would have been entirely impossible.

The hadrosauri, which were herbivora, had their teeth arranged in several rows that formed, through wear, a grinding surface in the form of a checker board. In the herbivora which have been grouped under the name of ornithopodia the intermaxillaries were not provided with teeth, and the same was the case with the extremity of the lower jaw, which was very likely armed during life with a horny beak; by means of which the animal cut off the buds and leaves that constituted its food.

Many dinosaurs had naked skin. In others, that are designated as stegosauri, the body was protected by bony shields and by spines.

We are acquainted with dinosaurs of all sizes, from the gigantic atlantosaurus of the Rocky Mountains, which attained a length of at least 80 feet, down to the nanosaurus, which was scarcely as large as a cat.

The secondary epoch, in which the dinosaurs lived, has justly been entitled the reign of reptiles. It was then that this group reached its maximum development. The mammals were very puny during this epoch, and were represented solely by the most inferior kinds. The dinosaurs seem to have then played upon the surface of the globe the role that the large carnivora and herbivora do now; but, while mammals have always gone on improving until they already offered at the end of the Tertiary epoch the magnificent development which we now see, reptiles have gone on continuously diminishing in importance. The higher animals have gradually excelled beings of a less perfect organization.

Dating from the Triassic epoch, the dinosaurs were already represented by so diverse types that it seems as if these were the descendants of animals that existed at a more remote epoch. It was at the end of the secondary epoch that these animals disappeared forever without leaving any descendants. They were unable to adapt themselves to the new conditions of existence that were imposed upon them, and they died, while the mammals, on the contrary, daily proceeded more toward the highest types.

The temperature was high during the Jurassic epoch, and uniform throughout the earth, as demonstrated by the existence in the north of Europe of corals comparable with those of the Gulf of Mexico or the South Sea. During the upper Jurassic epoch our country must have been cut up into lagoons, marshes, and frequently inundated estuaries. These privileged localities had a richer and more varied vegetation than the mountainous portions. Here grew large ferns with leathery fronds, while the declivities and uplands were covered with plants that approached the pandani, araucariæ, and cycads, and having almond-like seeds that formed the food of the herbivorous dinosaurs of the epoch.

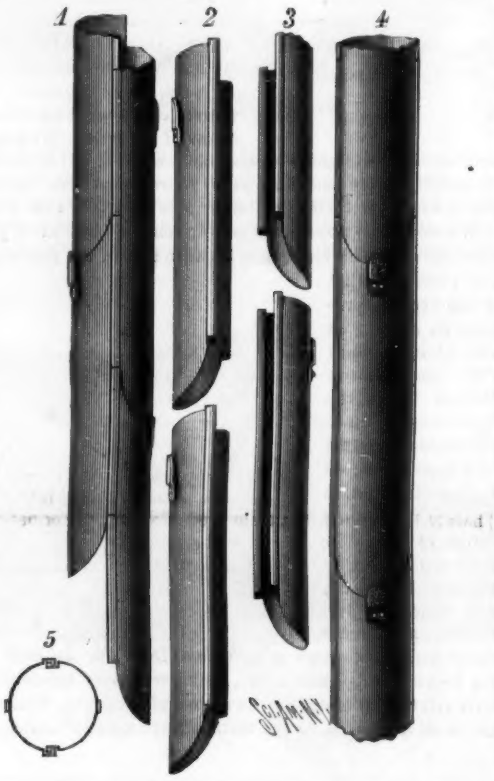
If, through the admirable discoveries that have been made in recent years, we endeavor to bring to life again the fauna of the upper Jurassic period in the United States, we shall find one that is no less rich and strange than that of the Old World. Here we have, amid araucariæ and cycads, the gigantic stegosaurus, with a body clothed with bony plates and spines, that formed a powerful armor for it, and with fore legs much shorter than the hind ones; the compsonotus, with fore paws equally as well developed as the hind ones; and the strange flying reptiles, the pterodactyls (Fig. 3).

Among the animals found in the Rocky Mountains, the strangest beast is doubtless the brontosaurus, of whose skeleton we give a restoration according to Prof. Marsh (Fig. 4). This animal reached a gigantic size; living, it must have weighed at least thirty tons! The head is remarkably small for an animal of such a size. The brain, which is extremely small, indicates a slow and stupid beast. The neck is long, flexible, strong, and very mobile, the legs are massive, and the bones solid. The animal walked after the manner of our present bears, its body was entirely naked, its habits more or less aquatic, and it must have frequented muddy swamps pretty much as the hippopotamus does. Its food consisted of plants that grew in the water or near the banks.

Not far from the French frontier, between Mons and Tournay, in Belgium, is located the Bernissart coal mine. In order to reach the bed of coal it is necessary in that country to excavate the earth to a certain depth, and traverse strata which were deposited subsequent to the formation of the valuable combustible. In making researches at Bernissart for extracting coal, some wealden strata were encountered in a valley that dated from the beginning of the Cretaceous epoch, and that was afterward filled through the movements of the earth. Fishes by hundreds, crocodiles of unknown types, and gigantic reptiles here lay buried at a depth of almost 1,150 feet, nearly in the spot where they formerly lived. They were buried in mud, and lay pellmell along with the plants that grew upon the ground that they had trod at an epoch so remote as to exceed all imagination. These gigantic animals thus brought to light, thanks to the persevering researches of De Paux and Sohier, were dinosaurs belonging to the genus iguanodon, the first remains of which were found by Mantell in 1822.

It is to the labors of Boulenger and Van Beneden, and especially to those of Dollo, that we owe our knowledge of one of the strangest beings that ever existed in olden times. The discovery of the Bernissart iguanodon—an animal whose entire skeleton is now known—has thrown an absolutely new light upon the structure of a whole group of herbivorous dinosaurs.

Everything, in fact, is strange in the iguanodon (Fig. 5). Its stature, as well as its gait, is well calculated to astonish



HIRSCHMANN'S IMPROVED STOVE AND OTHER PIPES.

the naturalist who is acquainted with existing reptiles only—beings which are very puny as compared with animals that lived in former times.

The Bernissart iguanodon measures nearly thirty-three feet from the end of the nose to the tip of the tail, and, when standing upright upon its hind legs (the attitude that it assumed in walking), it rose to more that thirteen feet above the level of the ground. The head is relatively small and much compressed, and the nostrils are spacious and as if partitioned. The temporal fossa is limited by a bony arch, above as well as below—a character entirely exceptional in existing reptiles. The extremity of the jaws must likely have been provided with a beak designed for cutting the large ferns and the cycadaceæ that grew upon the margins of the lagoons and marshes into which the earth was cut up. The teeth, which are crenulate at the edges, indicate an essentially herbivorous diet, and they were replaced as soon as worn out. The neck must have been very mobile. The ribs, which are strong, indicate vast lungs. The fore limbs, shorter than the hind ones, terminate in a five fingered hand. The thumb is provided with a large spur, which must have been a formidable weapon. The hind limb, which is digitigrade, is provided with but three fingers, which were probably connected by a web. The pelvis more closely resembles that of birds than that of existing reptiles. The tail, a little longer than the rest of the body, is about sixteen feet in length, and consists of nearly fifty vertebræ. It is much compressed laterally, like that of the crocodiles, and must have served as a rapid and powerful means of propulsion.

"The circumstances under which the Bernissart iguanodons were found show, as Mr. Dupont has pointed out, that these animals must have lived in the midst of marshes and upon the banks of a river. It is consequently not surprising that they had aquatic habits.

"Granting that the iguanodons passed a portion of their existence in water, we can imagine, by the aid of observations made upon the crocodile and *amblyrrhyncus* (a large marine lizard of the Galapagos Islands), two very different modes of progression of our dinosaur in the liquid element.

"When it was swimming slowly, it made use of its four limbs and its tail. If, on the contrary, it wished to move forward rapidly in order to escape its enemies, it placed its fore limbs against its body, and made exclusive use of its hind ones and of its caudal appendage. In this mode of progression, it is clear that the smaller the fore paws are the more they are hidden, and consequently the less resistance they offer to the movement of the animal in the water. In confirmation of this, we observe that, among the forms that swim in the manner just stated, the fore limbs are so much the smaller in proportion as the beast is the more aquatic.

"The iguanodons walked on the ground by the aid of their hind legs only; in other words, they were bipeds after the manner of man and of a large number of birds, and were not jumpers like the kangaroo; moreover, they did not rest upon the tail, but allowed it simply to drag.

"But, it will be said, just now, in speaking of aquatic life, you compared the iguanodon with the crocodiles; yet the latter are not adapted for an erect attitude. What need, then, had the iguanodons of a bipedal walk if they had analogous habits? It appears to us, on the contrary, that standing upright must have been a great progress, and for the following reason:

"These animals, being herbivorous, had to serve as prey to the carnivora of their epoch; and, on another hand, they remained in the midst of marshes. Among the ferns by which they were surrounded they would have observed the approach of their enemies with difficulty, or not at all; but, standing upright, they were enabled to look about them to a considerable distance. Upright, too, it was in their power to seize their aggressor between their short, but powerful arms, and to bury their two enormous spurs into its body. These spurs, it is probable, were provided with a cutting edge.

"The difficult progression of the crocodile upon the ground has been described by all travelers, and there can be no doubt that the long tail of this animal contributes not a little to its awkward gait. The transformation of this cumbersome organ out of water into a balance was, it seems to us, a happy modification.

"Finally, the bipedal walk must certainly have allowed the iguanodon to more quickly regain the river or lake in which it disported than would a quadrupedal walk that was continually interfered with by numerous aquatic plants that played, after a manner, the role of brushwood."*—*Science et Nature.*

IMPROVED STOVE AND OTHER PIPES.

The pipe shown in the accompanying engraving is made up of sections fitting together by longtudinally sliding lock-joints, the ends of the sections being formed with projections for overlapping. By this method of construction a very strong pipe is obtained, time and labor are economized in putting it up, and space saved when storing or transporting it. Fig. 1 is a side view, showing the lock-joint. Figs. 2 and 3 show the sections detached. Fig. 4 is a front view, showing the transverse joints and metal catches; and Fig. 5 is a cross section. The longitudinal edges of each section are bent to form a half-lap folding or sliding joint, as very clearly indicated in Fig. 5. One end of each section is cut square across, and the other end is extended, so that when two sections are united, end to end, this projection will pass under a sheet or cast metal catch, upon the squared end of the adjoining section; if considered desirable, the catches can be made ornamental. Elbows for such a pipe may be similarly constructed, or the pipe may be fitted with the common elbow. The parts are so assembled that the transverse joints will be in the middle of each section. The sliding longitudinal joints readily fit one within the other, and give the pipe increased strength, so that it may be connected for a longer distance than a riveted pipe without the necessity of holding it to the ceiling or elsewhere by wire.

This invention has been patented by F. L. Hirschmann, M.D., of Norway, Mich.

Training of the Young.

A remark made in one of the papers read before the recent Woman's Congress in Baltimore suggests an interesting argument in favor of the kindergarten. It is well known that, in its development, each new born being passes through very much the same stages that his ancestors have been through before him. Even after birth the growth of the child's intelligence simulates the progress of the human race from the savage condition to that of civilization. It has been shown by Preyer, and others who have studied infant development, that a faculty which has been acquired by the race at a late stage is late in making its appearance in the child. Now, reading and writing are arts of comparatively recent achievement. Savage man could reap and sow, and weave, and build houses, long before he could communicate his thoughts to a person at a distance by means of written speech. There is, then, reason to believe that a child's general intelligence would be best trained by making him skillful in many kinds of manual labor before beginning to torture him with letters; and the moral to be derived is, that primary instruction should be instruction in manual dexterity, and that reading and writing could be learned with pleasure and with ease by a child who had been fitted for taking them up by the right kind of preparation. The argument is a novel one, and it certainly seems plausible.—*Science.*

* L. Dollo, Les Iguanodons de Bernissart.

The Boring of Marine Animals in Timber.

Prof. McIntosh lately delivered a lecture on this subject before the International Forestry Exhibition, Edinburgh. He began by stating that the burrowing of marine forms was a feature familiar to every zoologist, for scarcely a dead shell could be dredged from the sea bed that was not perforated by boring sponges. In the same way the surface of the limestone rocks of our southern shores was riddled by those sponges. So far as at present known, sponges bored only in calcareous substances, and there was a difference of opinion as to whether the agent in boring was the spicules or the soft animal jelly of the sponge.

As regarded the boring of the purple sea urchins in gneiss and granite, the teeth were the main agency in the perforations. The group of annelids included many boring and burrowing forms, some perforating sand and others earth; while many bored in aluminous shale, sandstone, limestone, shells, and various substances. Each form, moreover, made a characteristic tunnel in the rock, so that the borer could in most cases be determined. None, however, bored wood, and though pieces of telegraph cable had been several times sent him, with accompanying annelids as the depredators, in no instance had the lecturer been able to connect them with the injury. There could be little doubt that those forms performed a useful function in the disintegration of dead shells and in corroding the surface of calcareous and other rocks

The crustaceans and the mollusks were groups that were conspicuous in the perforation of wood and allied materials. Of crabs, the *Cheluria terebrans*, a form less familiar to Scottish zoologists than to their southern colleagues, was in xylophagous powers even more destructive than the common Scotch boring crab—the gribble—its excavations being considerably larger and more oblique. Though the gribble—*Limnoria lignorum*—must have been familiar to observers from a very early period, it was first described by Dr. Leach only in 1811, when Mr. Robert Stevenson, the celebrated engineer, found it burrowing most destructively in the large beams of Memel fir supporting the temporary beacon on the Bell rock. Other logs of pine on the rock were reduced at rate of about an inch a year, and the house timbers were so much destroyed by the gribble that many stood clear of the rock, supported only by the iron bolts and stanchions. It attacked all kinds of submarine woods; and the late Dr. Coldstream, Leith, had told them that in 1825 so extensive were the ravages of this creature that many of the piles of Trinity Chain Pier had to be replaced after four years' service, and studded all over with broad headed nails from the base to the limit of high water mark.

Having described the structure of the gribble and its mode of boring, the lecturer said it had also acquired the habit of perforating the protecting envelopes and gutta percha in which submarine telegraph cables were sheathed. The work of the burrowing crabs, however, was quite overshadowed by the far more serious encroachments which the boring shell fishes were capable of making in timber and similar substances, as well as in rocks of various kinds. Prof. McIntosh pointed out the boring of the pholas and date shells in rocks, and went on to describe the destruction caused by xycophaga, which was to be seen in the deep water off the Firth of Forth, and elsewhere in England and Scotland. It was, he said, a little bivalve shell fish or mollusk, intermediate in structure between the stone boring pholas and the strictly wood boring teredo. There was very little externally in the wood attacked by this form to attract attention, except the presence on the surface of minute apertures, which indicated the points by which the young animals had entered; but on breaking open the wood the adults were found in smooth tunnels in every fragment large enough to afford a lodgment.

The most conspicuous genus of wood borer, however, was the teredo, or ship worm, species of which occurred in every ocean. In the tube of the teredo the annelid (*Nereilepas*) was often found, and some observers maintained that it was the destroyer of the teredo, but the lecturer had some hesitation in subscribing to that theory. The very same species of annelid occurred abundantly along with the common hermit crab in the shells of the great whelk, and the association of annelids with other forms in tubes or elsewhere was extremely common; but it was not for the purpose of preying on their neighbors, though the bodies of their hosts were in many cases softer than those of the teredo; they were what zoologists called messmates—dwelling in association with other animals. The object in life of all the species of teredo was to bore ceaselessly into timber, the tunnels in which varied from one to two feet in length in the case of the common teredo to fully a yard in the great teredo.

Prof. McIntosh then gave a brief outline of the history of the teredo, which appeared to be mentioned for the first time in the Knights of Aristophanes, and said that the French and Dutch suffered much more seriously from its ravages than we did. The theories that had been brought forward to explain the mode by which marine animals perforated material so different as wood, limestone, wax, granite, and aluminous shale, might be ranged round two great centers—the chemical and the mechanical. The advocates of the chemical theory seemed to take it for granted that the borings occurred chiefly in calcareous substances, and with propriety, therefore, they made their solvent an acid.

That notion, however, was unable to explain the perforations in media totally impervious to such action, while no trace of acid was found in many borers; and while present in some, it was likewise characteristic of other marine animals that did not bore.

The mechanical theory, again, supposed that the animals perforated by means of shells or gritty particles in the case of mollusks, of teeth in sea urchins, bristles in annelids, and horny processes in certain sea acorns and gephyreans; but they were left in doubt concerning the extensive and wonderful excavations of the sponges, the bryozoa, and the rest of the cirripedes. Alluding to the methods of protecting submarine timber from the ravages of such animals as he had been speaking of, Prof. McIntosh said different kinds of wood were mentioned as being impenetrable by such boring action, but so far none had been successful. There were many preparations for the treatment of the wood before immersion. Soluble bitumen, silicated lime, and various compositions had each in turn been tried externally; while silicate of lime, creosote, and other fluids had been forced, under great pressure, into the tissue of the woods. The experiments of the Dutch Commissioners, who investigated the matter, had led them to the conclusion that no external protection other than metallic sheathing or the studding of the wood with broad headed nails would be successful in resisting the attacks of these borers, while the only impregnation they found reliable was creosoting.

In conclusion, Prof. McIntosh pointed out that while the Dutch, French, and other commissions had done material service in regard to the best means of protecting timber from the attacks of borers, the subject was by no means exhausted. On the contrary, it would form a fitting object for research at the marine laboratories which at last, he was glad to say, were being established on our coasts. That ceaseless boring of wood was not, however, an unmitigated evil. The masses of timber swept seaward by many foreign rivers would prove a serious impediment to navigation if the marine borers did not slowly but surely accomplish their dissolution. In the same way the relics of many a ship in the depths of the sea were disposed of, and even utilized for the increase of animal life, which was, directly or indirectly, connected with the food of fishes, and, consequently, with the welfare of man. The lecture was illustrated by a series of spirit and dry preparations and colored drawings.

Bavarian Beer.

Consul Horstmann, of Nuremberg, in a recent report, gives a very interesting account of the beer industry and consumption of Bavaria. To persons who have traveled through that beer guzzling country the statistics of the quantity of beer manufactured and consumed by its people can hardly be credited, but from the source the information is derived, its correctness cannot be denied.

Breweries were in existence in Bavaria previous to the founding of the city of Munich by Henry the Lion in 1158, but up to the fifteenth century the principal drinks of the inhabitants were mead, a fermented mixture of water, honey, and various fragrant herbs, and Bavarian wines. One of the first breweries established at Bavaria was at Weihenstephan in the year 1146, by the Bishop of Freising. In 1370 there were but three breweries in Munich, which number, in the course of two centuries, had increased to fifty-three. In the sixteenth century wheat beer was introduced into Munich from Bohemia, and threatened in the beginning to supersede the brown beer; but the opinion soon began to be held that white beer was not wholesome, and, moreover, it was contended that the consumption of wheat for that purpose would soon drain the country of that cereal, and there would be none left for other purposes. Different measures were taken to restrict the brewing of white beer, all of which proved failures, and eventually the Duke of Bavaria took to himself the sole right of brewing it, and thus was established the royal white brewery, which exists to the present day.

In 1881 there were 5,482 breweries in Bavaria, or rather more than one to every thousand inhabitants. In Munich the smaller breweries have been gradually swallowed up by the larger establishments, and there are now 29 breweries in the city, the largest of them using about 364,000 bushels of malt, and producing about 7,000,000 gallons of beer annually. Most of the beer produced in Bavaria is consumed in the country itself, only about seven per cent being exported, the principal cities taking part in this export being Munich, Kulmbach, Nuremberg, and Erlangen.

In the making of this beer two methods are in general use, the one by a process of infusion, the other by a process of decoction. The object of the mashing is not only to extract the sugar and the dextrin which is contained in the malt, but also to produce sugar and dextrin from the existing starch, with the help of the so called diastase of the malt and a temperature of 167° Fah. The process of infusion and of decoction differ from each other in the manner in which the temperature of the mash is raised to the proper degree for producing sugar. In the first named process the mash is brought up to the proper temperature without any part of it reaching the boiling point. In the process of decoction, which is the one universally practiced in Bavaria, the mash is brought up to the required temperature by putting a part of it in the kettle and heating it to the boiling point, and then conducting it back to the rest of the mash, so that the whole reaches a temperature of 125° Fah. A part is then put a second time in the kettle and boiled, and again returned to the rest of the mash, so that it reaches a temperature of 167° Fah. The proper temperature is generally reached by twice boiling a part of the mash, although in some few breweries it may be done in three successive boilings. This process takes more time, and requires greater attention, than the heating of the whole to a certain temperature, but better results are obtained by it. It produces a beer richer in dextrin, while by the method of infusion a beer is produced containing less dextrin but more alcohol. The Bavarian winter beer contains about 4 per cent, and the summer beer 4·5 per cent of alcohol, while porter contains from 6 to 7 per cent, and ale 6 to 9 per cent of alcohol.

The malt used for Bavarian beer is obtained partly from Bavaria itself and partly from Hungary, and the hops are mostly of Bavarian growth, these being universally acknowledged as the best. Consul Horstmann says that Bavaria takes the lead of all nations in the consumption of beer, the average annual consumption being 260 quarts per head of population, compared with 125 in England, 165 in Belgium, and 45 in the United States; and he estimates that at Munich the annual consumption reaches the enormous figure of 470 quarts for each person, or about one quart and a third daily.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Eastern District of Michigan.

PATENT PROCESS FOR MAKING BEER.

Brown, J.:

Where a patent clearly shows and describes a machine whose use necessarily involves the production of a certain process, no other person can afterward patent that process. The first patentee is entitled to his mechanism for every use of which it is capable, even though he did not foresee all of them.

An imperfect description, coupled with an incomplete drawing, is insufficient to invalidate a patent.

Business circulars which are sent only to persons engaged, or supposed to be engaged, in the trade are not such publications as section 4,886 of the law contemplates, and in a contest of priority will not afford a basis for a claim of prior invention as against a patentee.

The Meller & Hofmann patent, May 20, 1879, held to be anticipated by the Pfandler patent of July 2, 1878.

United States Circuit Court.—Southern District of New York.

ARNOLD *vs.* PHELPS *et al.*

Ashcroft reissued patent July 25, 1871.

Wheeler, J.:

A claim to the process of maturing and browning coffee by subjecting it in its uncured condition to the direct action of steam is not infringed by the application of heat only to the coffee in that condition, even though the heat generates steam from the moisture in the coffee. The steam cannot be omitted and the process be the same. Bill dismissed.

Automatic Arctic Exploration.

The Chicago *Current* says: Probably the most wonderful thing in connection with the whole sad history of Arctic exploration is the recent discovery of an ice floe in the waters of Davis' Strait—west of Greenland—which had drifted from a point in the Arctic Ocean northeast of the Lena delta—where the crew of the Jeannette divided into three parties and took to the open waters—to the southernmost point of Greenland, and north again to Baffin's Bay. Upon this floe were a corpse and many indubitable relics of the expedition, including an article of wearing apparel marked with the name of Seaman Noros, who, it will be remembered, in company with Seaman Nindermann went a few miles ahead of poor De Long, and lived to write the most extraordinary experience ever penned by a human hand. Had these two simple seamen been able to tell, in the Siberian tongue, that their comrades were only eleven miles back, the whole De Long party would have lived to join Melville and Danenhower.

Now the floe discovered by the Greenlanders has, perhaps crossed directly over the North Pole. From the Jeannette floe to the southern point of Greenland, in a direct line across the Pole, is 3,500 miles, but by way of the northern shore of Asia and Europe—past Cape Northeast, Nova Zembla, Spitzbergen, and Iceland, and north again into Baffin's Bay—would be a distance of at least 6,000 miles. Scientifically, the life of a moving ice floe for so many years, and its migration from one side of the world to the other, ought to furnish suggestions and data more valuable than all the other fruits of polar research combined. Self-registering meteorological apparatus, and possible gauges of the miles traveled, may in the future reveal to the investigators what the sacrifice of thousands of lives has otherwise failed to discover.

The Cheapest Antiseptic.

M. Pasteur anticipates that bisulphide of carbon will become the most efficacious of all antiseptics, as it is also the cheapest, costing but a fraction of a penny per pound in large quantity. It is also the best insecticide known, and for this purpose may, perhaps, be useful to preserve woodwork in tropical countries. Some idea of the use it is already put to may be gathered from the fact that over eight million pounds of the substance are used annually to check the ravages of phylloxera. Carbon bisulphide, as first produced, is about as foul smelling a compound as it is possible to find; but it is capable of purification till all offensive odor is removed, and it is sufficiently pure in smell almost to mix with a perfume.

ENGINEERING INVENTIONS.

A semaphore signal has been patented by Mr. William Thornburgh, of Elyria, Ohio. With an upright frame, having tubular standards, sliding rods, and wings, a lantern box and glass sides, are various novel details and combinations for governing and regulating the movements of railway trains at crossings, drawbridges, block stations, etc.

A valve gear for engines has been patented by Mr. Francis C. Simonds, of Kennebunk, Me. This invention covers such special construction and arrangement of parts that the full pressure of steam will be on the engine at all times, and the amount allowed to enter the cylinder will be regulated by the greater or less opening of the valves by the regulator, according to the load.

A railroad signal system has been patented by Messrs. William Hadden, of Brooklyn, N. Y., and Henry Van Hoevenbergh, of Elizabeth, N. J. A continuous electric current is employed for holding signal banners in position to indicate safety, and the current is rapidly interrupted to weaken the power of the signal magnet and allow the signal banner to fall to indicate danger, this being effected by a peculiar combination of track instruments, interrupters, and magnets.

AGRICULTURAL INVENTIONS.

A horse hoe has been patented by Mr. Marcus Hardenbrook, of Marysville, Kansas. It is made with fenders upon the inner ends of the hoes to protect small plants from the soil thrown by the hoes, and there are readily adjustable gauge wheels and standards, the object being to facilitate the cultivation of small plants.

A sulky harrow has been patented by Messrs. Armelder F. Pack and Edwin French, of Emporia, Kansas. This invention covers improved appliances for raising up the harrows to suspend them from the axle when required, and to lower them to the ground again, the object being to simplify the appliances, improve their efficiency, and lessen the labor of operating them.

A cultivator has been patented by Messrs. Fred Hani and Charles A. Billington, of Morrill, Kansas. It is made with curved bars or runners, and inclined beams connected at their forward ends with each other and the curved bars by upright bars having horizontal overlapping upper ends, connected at their rear ends by an adjustable arched bar, and provided with cutters and fenders, the cultivator being especially adapted for cultivating small corn planted in furrows between the ridges in listed land.

MISCELLANEOUS INVENTIONS.

A fruit and flower stand has been patented by Mr. George W. Fry, of Beaver, Pa. It is formed of a series of bowls or dishes united by detachable standards, a sprinkler and water receptacle being held on the uppermost stem, the whole being so constructed that it can be taken apart and compactly folded.

A tallying attachment for measures has been patented by Mr. James A. McIntosh, of Warren, Pa. This is for vessels employed to measure liquids, to record the number of times the measure is emptied, and consists of a sliding handle, with an index moving in front of a dial, carried by a pawl and ratchet attachments operated by the sliding handle.

A camera has been patented by Messrs. William H. Lewis and Erastus B. Barker, of New York city. This invention covers certain novel features intended to make a lighter and more convenient instrument, and relates particularly to the folding bed, the means for securing the object glass in place, and the construction of the box.

A wagon top has been patented by Mr. Charles R. Parks, of Arkadelphia, Ark. In combination with a wagon box having longitudinal pockets on the sides is a removable wagon top, with base rails adapted to be passed into the pockets to hold the top on the wagon box, the pockets being fixed or removable.

A culinary vessel has been patented by Emily A. Stears, of Brooklyn, N. Y. This invention relates to vessels for cooking various kinds of food simultaneously, a tray, with sector shaped pan, fitting into a larger vessel, with convenient devices for passing off the vapors, allowing of a number of different dishes to be conveniently cooked at the same time.

A mail bag has been patented by Mr. Chas. F. Walters, of Prospect, N. Y. The bag is made of leather similarly to those now used, but has a novel sectional construction at and near the mouth end, and in the fastening, so that when being filled or being dumped the mouth is held open to present a full and clear opening.

An amalgam for filling teeth has been patented by Mr. Walter C. Davis, of St. Petersburg Place, Bayswater, Middlesex Co., England. Amalgam filings are coated, by a special process, with a varnish of gum and gold dust, so that each individual grain or particle of the amalgam is protected from the action of the atmosphere or the acid secretions of the mouth.

A barbed fence strip has been patented by Mr. Elbert E. Hawkins, of Wilkesbarre, Pa. The strip is bent to have a U-shaped cross section, and has tongues at the top edge punched alternately out of opposite sides of the strip, extending alternately in opposite directions, the strip being easily made from sheet metal.

A fire escape has been patented by Messrs. George H. Herrington and Martin Hellar, of Wichita, Kansas. It consists of one or more wires or wire ropes attached outside the building conveniently near the windows or doors of the different stories, and having successive guards of stirrups and loops, whereby persons may descend in case of fire.

A pump has been patented by Mr. John J. Bircher, of Wilmot, Ohio. This invention covers a novel construction in double acting pumps with a single barrel and duplicate valvular suckers, arranged to reciprocate toward and from each other, in order to obtain increased efficiency and simplicity, and a better working effect.

A freight elevator has been patented by Mr. Charles B. Paxton, of Vicksburg, Miss. It is more especially designed for loading and unloading boats at low stages of water, the construction allowing the stage, with elevating chains, to be raised and swung to the required height and position for the upper end to rest upon a dock or shore.

A process of making bread has been patented by Mr. Théophile Montérichard, of Paris, France. This process consists in mixing with the flour to make the dough water in which a small proportion of wheat has been previously boiled, then kneading and proceeding as in ordinary bread making, the water used being thus prepared to assist the separation of the glucose from the dextrine, give more body to the remainder of the dough, and increase the product of bread.

An apparatus for distilling has been patented by Mr. Franz Konig, of Asti, Italy. This invention provides a simple and inexpensive apparatus for distilling brandy, spirit, petroleum, etc., by passing their vapors through one or more chambers, over surfaces giving great exposure, and by contact of the vapors with the liquids, it being claimed possible therein to produce rectified alcohol of from 90° to 93° from fermented mash in shorter time and with less expense than by other usual apparatus.

A driving mechanism for clay tempering wheels has been patented by Mr. William Cram, of Raleigh, N. C. It is made with a fixed circular rack and a horizontal shaft rotated by suitable gearing and carrying a pinion meshing with the teeth of the fixed rack, the shaft being connected to the shaft of the tempering wheel, so tempering wheels may be operated with less power.

A safety lamp has been patented by Mr. Robert Mauchline, of Shenandoah, Pa. This invention covers a novel construction and arrangement of parts, making a lamp intended to show double the halo of a Davy lamp, and to indicate gas when the percentage is smaller than will be detected by the Davy lamp, and one that will be extinguished when raised into gas such as would endanger the bursting of a Davy lamp.

A canister for holding or measuring seeds, grain, or other substances has been patented by Mr. George S. Church, of Baldwin, Mich. The lower end of the canister is connected with a bell mouthed spout, to the lower end of which is secured a measuring tube, and by various novel devices the whole may be connected with a grain spout and used for measuring, or it may be used for storing and measuring rations for horses, etc.

A method of transforming Jerusalem artichoke juice into levulose and applying the product has been patented by Mr. Edmond L. J. Boniface, of Changy-les-Bois, par Varennes, Loiret, France. The method covers the application of an acid at a temperature of about 100 deg. Centigrade, either in open air or under pressure, and ways for the use of levulose in making alcohol, the manufacture of sirup, a special beer, levulose beer, and hygienic beverages, etc.

NEW BOOKS AND PUBLICATIONS.

DIE KABELTELEGRAPHIE. (Cable Telegraphy.) By Max Jullig. A. Hartleben, 1884. Wien, Pest, Leipzig. 256 pages.

This interesting work contains valuable information on the construction, insulation, and laying of underground and submarine cables, and a very interesting history of the use of cables from the first attempt made by Lesage at Geneva, in 1774, to the Bennett-Mackey cable of 1884. The electrical functions in cables, the instruments used in transmitting cable messages, and the relative values of insulating materials, have received special attention. The work contains 90 illustrations and diagrams.

FIFTY YEARS' OBSERVATION OF MEN AND EVENTS. By Gen. E. D. Keyes, U. S. A. Charles Scribner's Sons, New York.

The writer was for many years on the staff of Gen. Scott, and a great portion of the book is devoted to anecdotes in which that military chief figured, and reminiscences of the times in which he was a prominent figure in public life. The reader is never allowed to forget the personality of the author, and the part he had in military movements before and during the war, but the book is, withal, a sketchy and entertaining volume.

THREE VISITS TO AMERICA. By Emily Faithfull. Fowler & Wells Co., New York.

As is well known, Miss Faithfull has for more than twenty years devoted herself to the enlargement of the field of labor for women, and her visits to this country have been for the purpose of studying our industrial methods and organizations in behalf of poor women. She is a warm hearted, practical observer, earnestly laboring for the improvement of the condition of women, and received many attentions while here from leading people in all walks of life. This volume describes, in entertaining style, her experiences in this country.

THE LEATHER MANUFACTURE IN THE UNITED STATES. By Jackson S. Schultz. Published by the *Shoe and Leather Reporter*, New York.

There is no other book now offered in the English language presenting anything like a satisfactory treatise on the manufacture of leather. Mr. Schultz comes to his task with advantages rarely possessed by an author, having been himself for more than a quarter of a century a prominent figure in the American leather trade. This volume, however, excellent as it is in its way, is altogether too brief, as it treats almost exclusively of the sole leather manufacture, but on this branch of the subject there is little left to be said. The book has a valuable appendix, giving full details of the methods adopted by the tanners of Pennsylvania and New York for burning wet spent tan, which furnishes abundance of power for operating all our sole leather tanneries.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) F. A. asks: What cement will best stick rubber bulbs to the ends of glass tubes (medicine droppers)? A. Heat the end of the glass tubes sufficiently hot, so that when the rubber is drawn over the tube it will melt slightly, and then adhere to the glass. 2. Do you suppose that the colors put up as dyes by several makers are subjected to any special process, or are they merely suitable aniline colors, put up in small envelopes for the convenience of small users? A. We are informed that the colors as put up in the manner referred to by you are simply small samples, and are not subjected to any special process.

(2) W. W. asks how to harden and color moulding knives on wood working machinery; the smith cannot get them even tempered. A. The profiles, or edges of the knives, are probably of curved form, one portion projecting more than another. No heating and drawing over a smith's fire can be even for such work. Heat the knives in red hot lead; harden in cold water; brighten and draw (in hot sand) to a "pigeon breast" red and blue.

(3) G. M. S. writes: There is something in the water, sulphur I think, which is rapidly eating holes into the feed pump rods and other parts of my engine, and probably ruining my boilers. How can I stop it? A. A little sal soda added to the feed water will probably neutralize any acid that may be cutting the interior of boilers and pump. If you feed from a tank, place the soda in the tank—1 or 2 ounces to 100 gallons. Blow off the boilers every day one or two cocks. You may find that much less soda will counteract the acidity. 2. How can I mend the broken drum of a cast 12 inch by 24 inch pulley? Can I cement it in any way? A. You cannot cement the pulley, but you can make a sheet iron rim for the inside of the pulley, one on each side about No. 16. Fit it in neatly, and rivet the broken pieces of the pulley to the sheet iron, also the parts that are not loose. If this is carefully done, you will not discover that it has been broken by its running. 3. Can I run a steel shaft and disk 100,000 revolutions per minute? Why not? A. It is very doubtful if a shaft and disk can be run 100,000 revolutions per minute. The difficulties are mechanical.

(4) E. E. K. asks: 1. Which is the best and cheapest way to make a water tube boiler of 12 one inch pipes 1 foot long? A. You may make a small upright boiler by plugging or welding heads in one end of the tubes and screwing the other end into the bottom of an iron cylinder, making the tube head five-sixteenths thick, the shell three-sixteenths. 2. Would it run an engine 1½x3? A. This will run your engine, but not with much power.

(5) C. G. L. writes: 1. In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 252, there are drawings for a telescope. What is the power of one (in diameters) when the meniscus lens is used with the eye piece as described? What would be the power if the achromatic lens with terrestrial eye piece were used? If by increasing the objective double, will the power of the telescope be increased in the same proportion, and can the same eye piece be used if the focus is the same? A. Find the magnifying power of the telescope by dividing the focal length of the objective by the focal length of the eye glass, all in inches. The terrestrial eye pieces are usually of the equivalent power of a single glass from 1 to 1½ inches focus. A good way is to make a direct comparison with one eye looking through the telescope and the other looking at the object.

(6) J. H. H. writes: I am running two horizontal tubular boilers 42 inches diameter by 11 feet between tube heads, 12 square feet fire grate surface, 38 three inch tubes 11 feet long. I use them for steam heating stoves in winter season, and run one of Otis' hydraulic elevators for one floor at 1 ton of coal per week in summer, including coal to bank fire nights and Sundays. In winter the elevator is run in connection with the steam heating, when I propose to not charge elevator with coal for banking fires, as I have to bank them anyway for other purposes, but only for coal to evaporate water enough to run elevator for 1 floor, which is 175 gallons of water evaporated per day, and 36 days per month. I estimate that 1 pound of coal per 1 gallon of water is as low an amount as I can charge the elevator to the credit of the steam heating in the winter. Approximation is the only method we have at hand for determining the cost of running the elevator in the above way; we would like you to tell us what would be a reasonable estimate. A. You say that it takes 1 ton per week for elevator in summer, and you propose to charge 1,050 pounds by your figures to the elevator in winter. If you had to run the elevator alone in winter, it would take at least 25 per cent more coal than you use in summer. We think that you should charge three-fourths of a ton per week to the elevator in winter.

(7) O. C. R. writes: 1. We have an hydraulic ram working under 8 feet fall, raising water 70 feet through three-eighths iron pipe; receiving tank lined with sheet copper, tinned inside. Slight corrosion has commenced, and small holes are developed,

either from free acids or insects. Commercial sealing wax was used for stopping the leaks; is there anything better than this to cover the plates and prevent further corrosion? Also have you sufficient data to say how long the pipes, (gas pipes) should last and not suffer from incrustations; length of same, 1,100 feet? A. If there are but few holes in the tank lining, the surface may be cleaned and the holes soldered up, or little patches of thin copper soldered over the holes. Then clean the tank thoroughly, and paint the inside with red oxide of iron and boiled linseed oil (Prince's metallic paint). Iron pipes if small close up by corrosion in from 3 to 6 years, according to the quality of the water. 2. We have a turret turbine that is corroded badly, and thereby prevents a free opening of gate; is there any fluid that could be put on to cut the rust and cause a free working of the gates, better than kerosene oil? A. For clearing the rust from a turbine we know of nothing better than a scraper and painting as above. 3. Can No. 14 wire be used on an acoustic telephone by cabling each end securely to glass insulators and attaching smaller wire from the end of same to each diaphragm, or in other words does the sound travel through the metal or the wire move endwise in the vibrations of the transmitter? What is the best arrangement for a cheap and effective telephone, short line? A. Small wire, No. 22 to No. 24, should be used for an acoustic telephone, and connected directly to the transmitter, with sufficient rests to relieve the transmitter of undue strain. Small angles may be turned by passing around rubber suspenders. Vibrations are longitudinal. 4. Has heating by electricity been tried effectually, by whom and where, and what substances were tried as radiants for the electrical energy? A. Electricity is used only as a regulator of the heat, but does not furnish it.

(8) N. S. S. writes: I wish to paint an old building with crude petroleum. Please tell how I can treat the oil so as to make it dry readily without injuring its quality for the purpose needed. A. The only mixture that has any influence upon the petroleum as a paint lubricant may be found in resin and litharge; about 5 per cent resin powdered will be taken up by the petroleum, an equal quantity of litharge. Then add any common earth colors to thicken for a paint. The volatile part of the petroleum will evaporate, part of the oil will penetrate the wood, leaving the resin to cement the color.

(9) G. M. I.—The best arrangement for deafening floors is to have two distinct tiers of beams, one carrying the floor and the other the ceiling beneath. The ceiling beams are set lower than the floor beams, and between them. We then have the ceiling entirely separate from the floor, and there is nothing solid to carry the sound. Where this is not practicable, lay a double flooring with a layer of either concrete or felt between. The concrete will give a better result than the felt, but requires stronger beams. When the sound is to be deadened in the room containing the floor, the felt will probably give the best result.

(10) A. C. E. asks: How much internal pressure will a brass boiler 4 inches by 8 inches, one-sixteenth sheet, safely stand? A. Supposing the boiler to be 4 inches diameter, cylindrical, and 8 inches long, with raised heads, in the best form one-sixteenth inch best brass, it may be trusted to 15 pounds pressure. We do not approve of brass when copper can be had. In brazing the brass heads and seams you cannot use as strong brazing material as you can on copper, and more liable to injure the brass by burning.

(11) W. O. B.—Sodium and mercury combine readily under ordinary conditions by being brought in contact one with another. The union is attended with much hissing and spluttering. Johnson, Matthey & Co., the celebrated metallurgists of London, have a patented composition containing varying amounts of different metallic ingredients, including sodium. They prepare a concentrated amalgam, 10 pounds of which are to be used with 1,000 to 1,500 pounds mercury; the proportion of sodium employed does not exceed in all probability more than one per cent. How to make luminous paint is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 249, page 3971.

(12) O. F.—An occultation is the eclipsing of one planet by another or of a satellite by its primary. The occultation of the moon by the earth took place on October 4, visible in eastern part of the United States and Europe. It is a perfectly natural phenomenon, of often recurrence and of no import to any but cranks.

(13) J. W. D. asks how to purify crude sulphuric acid. A. By distilling in either glass or platinum retorts until perfectly pure.

(14) J. A. B.—We do not know of any chemical to mix with kerosene oil for cleaning brass. Oxalic acid and water is a powerful cleaning agent, and can be mixed with pumice stone and rotten stone for cleaning, and polish with the oil.

(15) C. J. L.—With a steam pump capable of pumping 62 gallons per minute through 1,000 feet of 2 inch pipe to a height of 100 feet you will require a 10 horse power boiler. An 8 horse power will do the work at 60 pounds pressure. The absolute power absorbed by the transit of the water is only about 2 horse power. The rest is waste, radiation, and friction of pump.

(16) H. C. C.—The usual size of saws for cutting split cord wood is from 18 to 20 inches. Your 2 horse treadmill will not drive a large saw for useful work.

(17) F. P. writes: I am using a solution of soap and water for toilet purposes; it thickens like jelly and will not flow from the bottle, while if I make it thin enough to flow it will be too thin for use. Is there anything I can add without injury to the soap that will make it flow about like molasses? A. Use glycerine or glycerine and alcohol. The exact proportions would have to be determined by experiment.

(18) J. H. W. asks: Which of two screws will stand the greatest strain—one of ten threads and the other of twelve threads to the inch; threads to be square, the thread on one end to be right hand and on the other end left hand, sliding in a nut embracing about one-third the diameter of the screw, the right and left hand ends pulling, of course, in opposite directions? A. The question is not one of the relative strength of threaded bolts; its conditions are those of a "worm" and "worm gear." The coarser thread is the stronger.

(19) W. S. R.—The best as well as the cheapest way of using pennyroyal to get rid of fleas is to use the herb itself; the oil, of course, cannot be used where the inconvenience attending it would be greater than the evil to be overcome.

(20) T. D. & Co. ask: What is done with the dross of zinc left at the bottom of galvanizing pots? A. Galvanizing works here sell all their dross to refiners. SCIENTIFIC AMERICAN SUPPLEMENT, No. 176, gives two or three modes of treating the dross.

(21) J. A. T. asks: Is there any oil that annatto will assimilate with thoroughly, and yet not increase the thickness of the oil to any marked degree? If so, what is the process? A. Annatto is soluble both in the essential oils, as oil of turpentine, and in fixed oils. You have your choice therefore of using almost any oil you please. Cotton seed oil will probably suit.

(22) A. F. S.—There is no method of applying a permanent coating of silver without a battery. Knives are sometimes coated with tin, which gives them a white appearance something like silver. This is done by thoroughly cleaning the surface, and then dipping the knife endwise into melted tin covered with oil or wax to prevent oxidation.

(23) W. H. R. asks for a chemical or combination of chemicals which upon exposure to the light will turn instantly black. Preparations of nitrate of silver are too slow in their action to answer my purposes. A. There is no chemical, as far as we know, that will so turn black on being exposed to the light. The silver salts are considered the most sensitive in their behavior toward light.

(24) N. H. asks how long a balloon one foot in diameter is required to lift ten pounds? Also how long a balloon of eighteen inches to lift ten pounds? Also the best method to cover a balloon so as to make it gas tight. A. For 1 foot diameter, 180 feet long; for 18 inches diameter, 80 feet long. Rubber varnish is probably as good as any for balloons. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 312, 249, 413, about balloons and their construction.

(25) H. J. O asks to be informed of the ingredients used in making good sporting powder, and the proportions of each used; and also what is used for glazing it, and how it is glazed. A. The exact proportions vary with the different manufacturers. According to Crookes, the following figures express approximately the composition of the best kinds of sporting powder:

Saltpeter	74·84	per cent.
Sulphur	11·84	"
Charcoal	13·32	"

The glazing is accomplished by causing the grains to rub against each other in revolving wooden barrels.

(26) W. writes: A favorite glaze among the potteries in Iowa is composed as follows:

Oxide lead	55
Feldspar (calcined)	25
Flint "	15
White clay	10
Paris white	5
	100

Practical potters differ in their opinions as to the object and effect of each of these ingredients, and also as to how their respective proportions are determined; will the SCIENTIFIC AMERICAN please explain? This glaze fuses at about 2,000° Fah. A. Practical potters, as you say, differ as to the object and effect of these ingredients. Their use has grown up from experience, without any definite cause or reason why they should be used, more than that they accomplish the purpose. The oxide of lead probably increases the fluidity of the other substances which are used, likely as tending to produce the glaze proper. The exact proportions can easily be determined by quantitative analysis.

(27) H. A. H.—For your purpose in coating chromos we would recommend you to use wax dissolved in ether or benzine, or else take ordinary white shellac varnish and dilute it with alcohol.

(28) J. W. T. writes: How can I heat chafing dishes from boiler that now heats the house by coils of pipe, or will I have to get a separate boiler? A. You may make a flat coil, and set the dishes upon it. The steam may be made to circulate from the house-heating supply pipes for winter service. At other times a hot water circulation from the kitchen boiler may be utilized.

(29) C. V. D.—Zinc is the most sensitive of the metals. It expands and contracts two one-hundredths of an inch in 10 feet for a change of 10° in temperature. Glass expands and contracts the least. Rods of glass and zinc arranged together make a good thermostat. Also some use sheet brass and sheet iron soldered together and coiled in a helix.

(30) W. J. K. asks: Is there any way in which I can keep oysters longer than one week in a cellar, and if I can feed them in any way? A. There is no way of feeding oysters. They are best kept in a cool, damp, dark cellar, and under such circumstances they will sometimes live as long as two months, oysters generally getting fatter and better when so kept a few days. 2. A receipt for making ice cream on a small scale. A. The following is given by Marion Harland: 1 quart rich milk, 8 eggs—white and yolks beaten separately, and very light—4 cups sugar, 3 pints rich sweet cream, 5 teaspoonfuls, or other seasoning, or 1 vanilla bean, broken in two, boiled in the custard and left in until it is cold.

(31) J. S. writes for a simple method of finding the amount of water per horse power per hour consumed by an engine, by the indicator diagram, and says Haswell gives a method and example on page 572, where he says: "Volume of steam at above pressure (15·3) compared with water (15·3+14·7)—883." Where does he get the 883? A. By turning to page 574, you will find the volume of steam for 1 cubic foot of water for pressures up to 200 pounds. A blunder in the steam tables makes it necessary to add the atmospheric pressure—14·7 pounds—to the indicated pressure in your boiler in order to obtain the tabulated volume due to the pressure. Hence 70 pounds + 14·7 pounds = 84·7. Opposite this number you will find, by interpolating the fraction, (nearly) 344 cubic feet, which is equivalent to 1 cubic foot of water at 70 pounds pressure. There is a typographical error in the sign quoted from Haswell; × should be +, which is the index for the tabular number 883. Thus for your engine we find area of cylinder 201 square inches, length of stroke 18 inches, cut off by card 0·5 inch, whole length of card 3·64 inches; then

$$\frac{18'' \times 0{\cdot}5''}{3{\cdot}64''} = 2{\cdot}473+ \text{ inches} = \text{length of stroke at moment}$$

of cut off 2·473 inches × 201 square inches × 2 (2 half strokes) = 497 + cubic inches = volume for 1 stroke.

$$497 \text{ cubic inches} \times 150 \times 60 = \frac{4{,}473{,}000}{1728} = 2588 \text{ cubic feet}$$

of steam per hour; pressure on boiler 70 lb.
atmospheric pressure 14·7 "
84·7 "

Page 574, tabular number for 84 pounds is 346, and for 85 is 342. The nearest whole number is 344, as explained above.

$$\frac{2588}{344} = 7{\cdot}52 \text{ cubic feet} \times 62{\cdot}5, \text{ weight of a}$$

cubic foot of water = 470 pounds of water per hour.

$$\frac{470}{\text{pounds of coal per hour}} = \text{pounds of water per}$$

pound of coal.

(32) F. D. R. asks: 1. Is there any soluble substance which can be made insoluble through currents of electricity? A. There is nothing, as we understand your question, that can be made insoluble by the electrical current. Decomposition, producing precipitation, as shown in the case of copper sulphate, results from the action of the current, but it is not the copper sulphate that is made insoluble, rather that it is decomposed. 2. Is there any chemical agent which will make a soluble substance insoluble? A. If potassium bichromate is added to glue and exposed to the light, the glue is rendered insoluble.

(33) J. R. M. writes: A friend claims that if you could put fresh ripe fruit in a vacuum, it would keep for an indefinite time. I say it will not keep a month. To put it another way: If you put fruit in a vessel and exhaust the air, how long will it keep in its natural state? A. Theoretically, the fruit would keep indefinitely, but it is an absolute impossibility to obtain any such vacuum, for the pores of the fruit are full of air. In canned fruits the cooking is supposed to destroy organic germs; then the cans are boiled to exclude air, a final pin hole being left for this purpose to be sealed up last; but even this cannot be said to absolutely get out all the air, and so there is a limit to the keeping qualities of all canned goods.

(34) A. G. asks: 1. How can I harden ordinary car spring rubber nearly as hard as soft wood, yet have it as tough after hardened as before? A. Rubber that has been vulcanized cannot be readily hardened unless it contains a greater proportion of sulphur than it should for spring rubber. In such case further vulcanization would harden it. 2. What can I mix with plaster Paris in casting small articles, to make it hard, to prevent being easily broken, to turn easily in a lathe; would like it as nearly white as possible; or do you know of any other composition or substance that can be turned in lathes? A. A small quantity of flour of marsh mallow added to your plaster will render it easy to turn, and harden it somewhat. Plaster mixed in a solution of alum becomes hard on setting.

(35) P. R. writes: In a lecture recently, the remark was made that water or any fluid would flow more steadily, or produce a steadier stream, through an elastic pipe than through a non-elastic one, or in other words, through a rubber pipe than an iron one, other conditions being the same. If so, what is the reason? A. We have no data in regard to comparative flow of water in solid and elastic pipes, but if the statement is true, it must be because the elasticity of the pipe lessens the friction.

(36) J. R. T. asks how walnut furniture is polished; I mean what is termed oiled walnut, such as sewing machines and fine bedsteads. I am not a furniture maker, but would often polish walnut articles, such as wall brackets, etc. A. There is an excellent wood filler now largely used. In the absence of this, first mix with good whiting such colors as will produce as near as possible the color of the wood to be filled. This mixture to be dry. Then give the wood a good coat of oil, and sprinkle the mixture over the work until it is pretty well covered; then with a soft rag or other substance rub this in well. Wipe off all superfluous material. Let dry thoroughly, and varnish. To give the highest degree of luster to varnish after it is laid on, it undergoes the process of polishing. This is performed by first rubbing it with very finely powdered pumice stone and water; afterward rub patiently with an oiled rag and tripoli until the required polish is produced. The surface is then cleaned off with soft linen cloths, cleaned of all greasiness with powdered starch, and then rubbed bright with the palm of the hand.

(37) J. P. L. writes: Would you let me know what the average price of mushrooms is per pound, during the year in New York, and when the season for them begins and when it ends? A. The price of cultivated mushrooms at Fulton Market averages 75 cents per pound, the wild 35 cents per pound. The season of the cultivated begins about January and ends in May; that of the wild extends from August to the middle of September.

(38) C. A. writes: Can you tell me how to make a good gold ink? Can it be made out of this gold paint or bronze powder? Also a good, bright silver ink. I want an ink that can be used with an ordinary steel or gold pen. A. Gold and silver inks are made as follows: 24 leaves gold, half an ounce bronze gold, 30 drops spirits of wine, 30 grains honey, 4 drachms gum arabic, 4 ounces rain water; rub the gold with the honey and gum, and having mixed it with the water, add the spirit; or else 1 part gold, 3 parts aqua regia; mix and evaporate until all the chlorine is driven off; cool, and mix well with ether and thicken with naphtha or essential oils. Use genuine goldleaf. For silver use either silver foil or leaf, dissolved in nitric acid, and thicken with naphtha or essential oils as described previously. You also will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, several recipes for gold and silver inks.

(39) J. H. N. wants to know of any one that ever was successful in making luminous yellow paint, after formula given in SCIENTIFIC AMERICAN, about a year ago. He has tried it every conceivable way, and it won't work. A. The manufacture of luminous paint will always be impracticable in this country until the exact nature of the calcium sulphide from which it is made is better understood. All that is in use at present is imported.

(40) J. R. C. asks for a formula of a black writing ink that will resist all tests. A. Dissolve 25 grains of powder gum copal in 200 grains of lavendar oil by the aid of a gentle heat, then add 2½ grains of lampblack and half a grain of powdered indigo.

(41) W. B. writes: Can I not secure a constant influx of fresh air for my stable by ending a pipe in the stable and carrying the other end up a hill above building far enough to give the air a proper head? Suppose I make this pipe of 4 inches diameter, would the air rise up through one inch perforations made at various places along its course in the building? If so, it appears to me that thorough ventilation can be attained, and that with air deprived of its chill in winter and its heat in summer. What is desired in stables as well as dwelling houses is avoidance of cold draughts of air. If air will escape through perforations made in the conduit, the stable man can easily attain perfect ventilation. A. The air will draw in at the perforations, provided there is any inducement by difference in gravity between outside and inside air in the uptake. This can only be obtained by heat in calm weather. Exposure to the heat of the sun of the vertical pipe will induce a current in the pipe on a still, unclouded day. A draught cap will do well for all times when you need ventilation the least; but when there is a dead, muggy air, all devices except artificial heat fail. A 4 inch pipe for a stable is entirely inadequate to its requirements; 8 or 10 inches diameter with artificial heat in the vertical pipe is the only means of obtaining proper ventilation when it is most needed.

(42) T. G. M. S.—At present writing we do not believe that there is any demand for ozokerite in this country; there have been several companies started for the purpose of working the Utah deposits, but until satisfactory means of refining the crude mineral are found they are not likely to do much. Its uses are the same as those of wax, and principally for the manufacture of paraffine candles. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 36, page 569, and also on page 6401 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 401.

(43) W. D. asks about the method of equipping buildings with perforated pipes, with the small holes sealed with metal that will melt at a low temperature, on the automatic shower principle. I want to know how to fit them, what size pipe is used, how far apart the holes should be and what size, and is there any patent on the principle? A. The automatic fire extinguishing apparatus, consisting of a system of pipes distributed throughout the mill, with fusible metal plugs and valve fastenings, is the subject of a great many patents, covering the details of apparatus and as much of the principle as a patent can cover. The kind that have small holes or open perforations to be flooded by opening valves in a protected place or on the outside of the building are, we believe, not now the subject of patent. It will be difficult to instruct you in the detail of these methods without an engineering study with plans of the building and the points that require particular protection; we think that you will best serve your interest by addressing the manufacturers of automatic apparatus.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. L. S.—The shiny flakes are graphite, a substance valuable in the arts for the manufacture of lead pencils, crucibles, stove polish, and lubricators. Its value is not very great, as it is a common mineral, and the larger factories own their own deposits.—L. S.—The specimen is pyrite, or iron sulphide, of no value.

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AND EACH BEARING THAT DATE.

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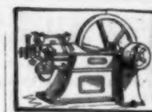

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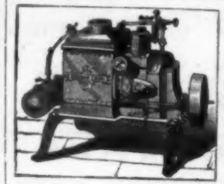

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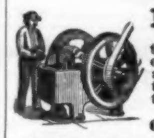

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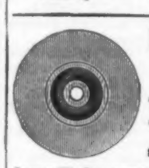

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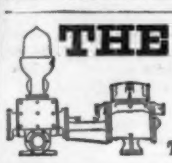

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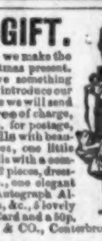

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